Stephan Schulmeister

Stabilizing asset prices through transition from continuous trading to electronic auctions

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Abstract

This chapter analyses a core component of what is defined in this volume as Permacrisis, namely, the pattern of asset price dynamics as sequence of "bull markets" and "bear markets". Based on this analysis, a new concept for stabilizing the "long swings" of asset prices is elaborated, namely, replacing continuous asset trading with electronic auctions. First, I sketch the channels through which the "overshooting" of exchange rates, commodities prices, and stock prices but also of EU carbon prices dampens the real economy and hampers fighting global heating. Second, a theoretical alternative to the still dominating "efficient market hypothesis" is presented, the "bull-bear-hypothesis". Third, I discuss the role of "technical" or "algorithmic" trading strategies in exploiting short-term asset price trends and strengthening them at the same time. Fourth, it is shown that bulls (bear) markets result from (very) short-term trends ("runs") in line with the prevailing (bullish or bearish) market sentiment lasting longer than counter-movements. Fifth, to mitigate the extent of the "long swings" of asset prices one needs to restrict (super) fast speculation unrelated to market fundamentals thereby dampening the short-term trending of asset prices. Instead of implementing a financial transactions tax, one could achieve this objective also through replacing continuous trading with electronic auctions, e.g., every three hours. This approach is theoretically more appealing, technically easy to implement and has so far not seriously been discussed.

Stabilizing asset prices through transition from continuous trading to electronic auctions

1. Introduction

In post-war history, economic development as well as framework conditions differed substantially between the prosperity phase of the 1950s and 1960s and the subsequent period of multiple crises which as a whole are conceived as Permacrisis in this volume.

In the prosperity phase, the framework conditions gave clear priority to activities in the real economy, the financial sector was conceived as its "servant". Hence, goods markets were liberalized, whereas financial markets remained strictly regulated. Those prices which are of fundamental importance for investment and trade like interest rates and exchange rates were stabilized by central banks and the international monetary system ("Bretton Woods"), respectively. Under "real-capitalistic" incentive conditions, the "core energy" of capitalist dynamics, i.e., striving for profits, was directed towards activities in the real economy.

Following the breakdown of the Bretton Woods system in 1971, two strong dollar depreciations triggered the "oil price shocks" in 1973 and 1979, which in turn triggered two global recessions. Inflation accelerated, fought by central banks through raising interest rates. Under the condition of widely fluctuating exchange rates and commodities prices together with interest rates exceeding the rate of economic growth, financial as well as non-financial business shifted their activities from real to financial investments. Under these "finance-capitalistic" conditions, economic growth has slowed down from decade to decade.

As a contribution to the first round of the Jean Monnet Network "Crisis – Equity – Democracy for Europe and Latin America", I sketched an overall picture of the systemic causes of the different economic performance in post-war development (Schulmeister, 2021). In the second round, my work focused on one core component of a finance-capitalistic regime, namely, the instability of asset prices and its impact on the real economy. My first contribution argues that the fluctuations of fossil energy prices and of carbon emission permit prices to prevent an anchoring of the expectation that the effective emission costs will steadily rise faster than target inflation. As anchoring such an expectation is necessary to sufficiently stimulate investments in avoiding CO_2 emissions, policy needs to fix rising price paths of crude oil, coal, and natural gas (Schulmeister, 2023).

The present contribution deals with the phenomenon of bull markets and bear markets which shapes the dynamics of asset prices in general. The "long swings" of stock prices, exchange rates, commodities prices, or house prices impact upon the real economy mainly through three channels, the distribution channel, the valuation channel, and the incentive channel with respect to the attractiveness of financial speculation relative to real investments.

The phenomenon of "long swings" of asset prices is closely related to the growing dominance of computer-based technical or "algo(rithmic)" trading systems which completely disregard market fundamentals. They exploit the phenomenon of "runs" (i.e., "mini trends") of exchange rates, stock and bond prices and commodity prices, and reinforce them at the same time. The sequence of "runs" accumulate into bull or bear markets because runs in line with the dominant – bullish or bearish – market sentiment last longer than counter-movements.

Mainstream economics cannot take into consideration the systemic causes of long swings of asset prices: If prices in those markets which come closest to the optimal market of equilibrium theory (as regards the homogeneity of "goods", accessibility, low transactions costs, etc.) persistently deviate from their fundamental equilibrium, then the entire paradigm can hardly be preserved. Hence, "overshooting" of asset prices is conventionally attributed to "shocks". Whereas concepts like "bullishness/bearishness", "overbought/oversold", "algo trading", etc. shape mindset and trading behaviour in asset markets, these concepts do not form part of mainstream economics.

The neglect of the actual trading behaviour in mainstream economics was and still is facilitated by the lack of an alternative approach which would generalize the stylized facts ("concrete theory"). Therefore, the "bull-bear-hypothesis" (BBH) is presented as an alternative to the still prevailing "efficient market hypothesis" (EMH). It is then shown that the BBH can explain the actual pattern of asset price dynamics to a much greater extent than the EMH. This result implies the following: If (very) fast trading becomes less attractive, then also the long swings of asset prices would be dampened since bull and bear markets are mainly brought about through the accumulation of (very) short-term trends.

There are two different ways how to reduce the (expected) profitability of short-term trading. The first method consists of a general financial transactions tax (FTT) which would render fast speculation unprofitable even at a tax rate as low as 0,01% (e. g., high frequency trading would disappear). The second method consists in moving from continuous trading in milliseconds to electronic auctions, e.g., every three hours. In this way, all types of (super) fast technical or algo trading systems could no longer be applied as they are cut off their input, i.e., the most recent high frequency price data. At the same time, traders would need to consider market fundamentals when placing their orders for the next auction.

The reminder of the chapter is structured as follows. The next section sketches the most important channels through which the instability of asset prices, in particular exchange rates, commodities prices, and stock prices impact upon the real economy and how the fluctuations of fossil energy prices and carbon emission prices impede an efficient carbon pricing. Then the prevailing "efficient market hypothesis" is compared to an alternative model of asset price dynamics, the "bull-bear-hypothesis". The next section explains how technical trading exploits asset price "runs" and strengthens them at the same time. Then it is shown how these trends accumulate to long-term bull markets and bear markets. The final section explains why replacing continuous trading with electronic auctions would stabilize asset prices over the short run as well as over the long run.

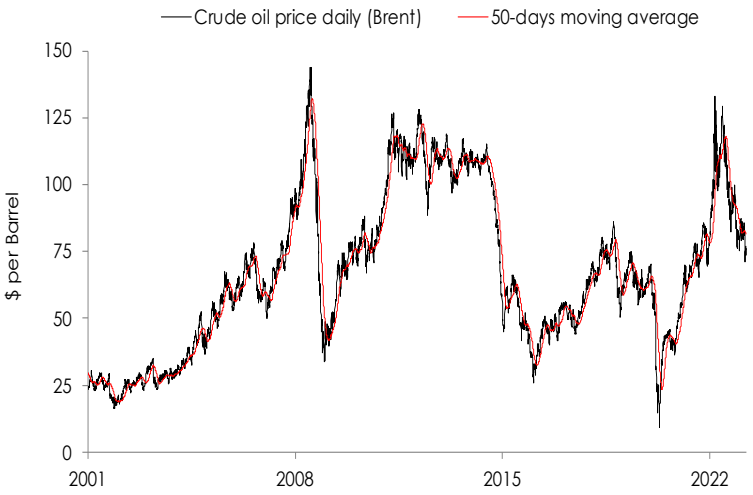
2. Asset price instability and the real economy

This section sketches answers to the following questions: How do the fluctuations of exchange rates, commodities prices, stock prices and interest rates impact upon the real economy? How has asset price instability contributed to the genesis of what is conceived as Permacrisis in this volume? Three different channels can be distinguished, the distribution channel, the valuation channel, and the incentive channel. Let us discuss first the distribution effect.

The distribution channel concerns the large shifts between the prices of commodities and industrial goods as well as their income and demand effects. Prices of the most important commodities are determined on derivatives - primarily futures - exchanges due to their high degree of homogeneity (in contrast to industrial goods). For the same reason, practically all commodities are priced in the same currency, i.e., the dollar as world currency. Commodities prices fluctuate much stronger than the prices of industrial goods, primarily for two reasons. First, the price elasticities of demand for and supply of commodities are low and supply shocks occur frequently. Second, destabilizing speculation in derivatives markets has become increasingly important.

Crude oil is by far the most traded single commodity. At the same time, supply shocks are most pronounced in oil markets due to the concentration of market power (OPEC cartel, big single producers like Saudi-Arabia or Russia) as well as due to political turbulences (from conflicts in the Middle East to Putin's war against Ukraine). The interaction of these factors causes oil price trends to be extraordinarily pronounced. Over the past 20 years alone, oil prices fluctuated in a sequence of (four) bull markets and (three) bear markets between $20 and (almost) $150 per barrel (figure 1).

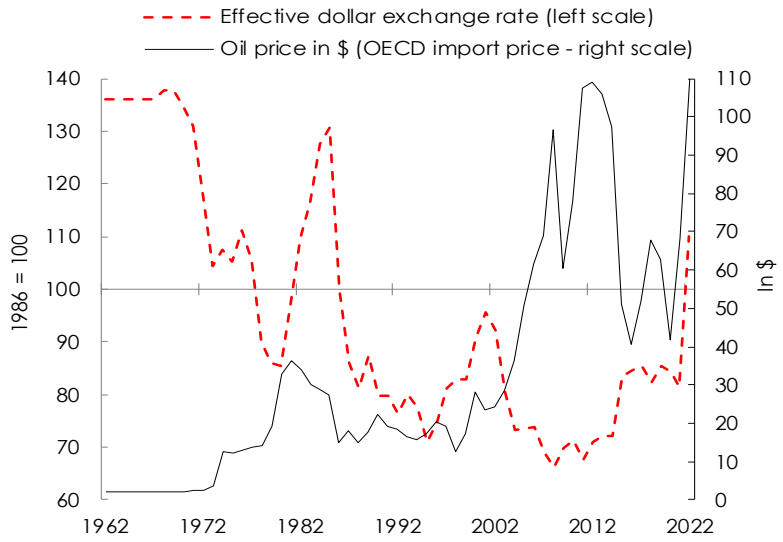
Figure 1: Trending and speculation in the crude oil futures market



Source: https://www.eia.gov/dnav/pet/hist/

The wide fluctuations of commodities prices induce massive redistributions in the global economy. Any commodities bull market shifts income from the net importers of commodities (mainly industrial countries) to net exporters. E.g., the recent crude oil bull market which took off already in mid-2020 (figure 1) caused earnings of oil exporting countries to almost explode at the expense of net importers of crude oil. Similar redistributions took place over the 1970s due to the "oil price shocks" of 1973 and 1979, respectively. When oil prices strongly decline as 1982/86 or 2014/15, income is redistributed in the opposite direction. The net effect of these redistributions on overall world trade is negative as the "winners" raise their import demand to a lesser extent than the "losers" reduce their imports.

Figure 2: Dollar exchange rate and oil price fluctuations



Source: OECD, IMF

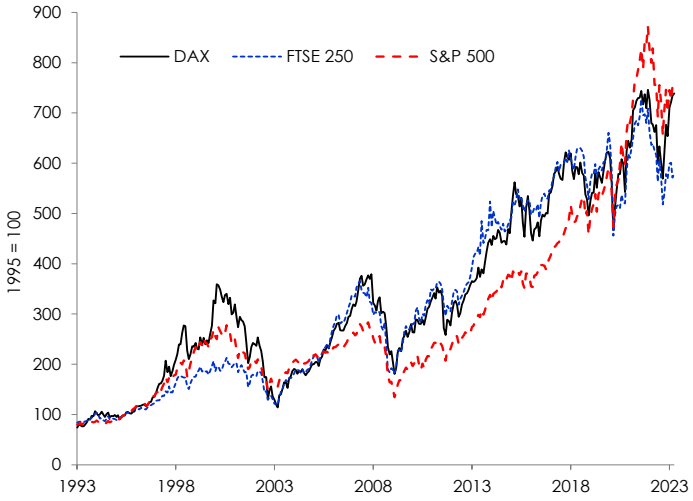
Bull and bear markets of oil prices are often inversely related to strong and preceding changes in the dollar exchange rate (figure 2). For example, following the suspension of the Bretton-Woods-system in August 1971, the dollar lost roughly 25% of its value (relative to the four other reserve currencies). This development hit most those countries which exported exclusively oil, which is exclusively priced in dollars, i.e., OPEC countries in the Middle East. This sequence repeated itself between 1976 and 1979. In both cases OPEC took advantage of political turbulences to put through the "oil price shocks" of 1973 and 1979 (Yom-Kippur-war and turmoil in Iran, respectively). When the dollar boomed again between 1980 and 1985, oil prices fell. Also, over the last 20 years, the movements of oil prices and the dollar exchange rate were (approximatively) inversely related to each other.

The main systemic reason for the pronounced bull and bear markets of the dollar consists of its double role as national currency of the US and as key currency of the world economy. As national currency, dollar exchange rate changes are influenced by national interests of the US. The (stepwise) revocation of the Bretton Woods system between 1971 and 1973, e.g., was mainly motivated by the interest of US policy to promote US exports. Ten years later, it became the predominant interest of US policy to fight inflation through increasing dollar interest rates which induced a sustained dollar appreciation (figure 2). As world currency, (significant) changes in the dollar interest rate and dollar exchange rate impact upon the global economy since most international debts are held in dollars and practically all commodities are priced in dollars (for a more detailed analysis of the double role of the dollar see Schulmeister, 2000).

Bull and bear markets affect the real economy also via the related wealth effects (valuation channel). In the international economy, the most important channel concerns the devaluation (revaluation) of dollar debts through any persistent depreciation (appreciation) of the dollar exchange rate. For example, the dollar declines over the 1970s incentivized countries to accumulate dollar debts (also fostered by low dollar interest rates). This effect was most pronounced in the then fastest growing economies, i.e., in Latin America. However, when the dollar began to strongly appreciate in 1980, the burden of dollar debts was revalued, leading into the debt crisis of 1982. In a similar - though much less pronounced - manner did the dollar appreciation which took off in 1995 contribute to the debt crisis in East Asia (Schulmeister, 2000).

Of course, a rising dollar exchange rate raises not only the value of dollar debts but also the value of the respective assets (credits). The overall effect on world trade is, however, negative since the import reduction on behalf of debtor countries is higher than the (possible) increase in imports on behalf of the creditor countries.

Figure 3: Stock prices in Germany, the United Kingdom and the USA

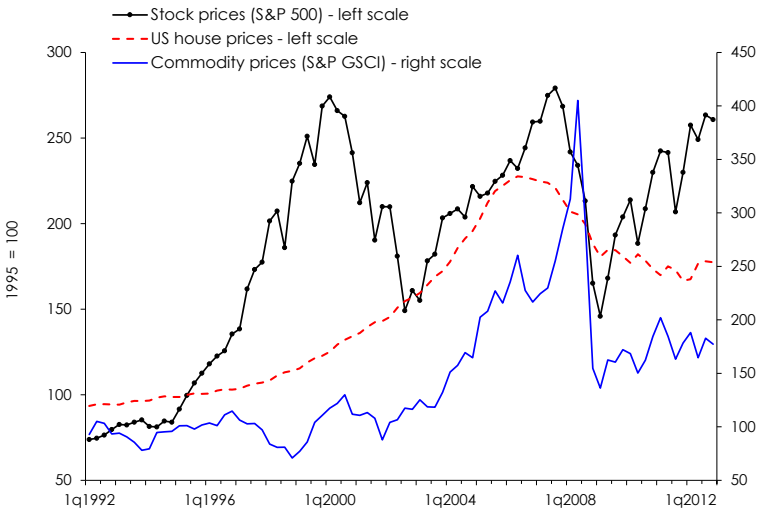


Source: Yahoo Finance

Since "equity assets" like stocks, real estate, commodities, or cryptocurrencies are nobody's liability, any bull market raises the value of the respective asset, and nobody loses. Such a wealth effect will stimulate private consumption provided that the asset holders do trust in the permanent character of the revaluation (valuation channel). For that reason, the stock price boom in the US over the 1990s did stimulate private consumption to a greater extent than the two bull markets following the bear markets in the early 2000s and after the financial crisis of 2008 (figure 3).

When a bear market devalues financial assets, the related negative wealth effects on demand can be compensated by a revaluation of real (estate) assets. Between 2000 and 2003, e.g., the negative wealth effect of the stock bear market ("bursting of the internet bubble") was roughly compensated by the positive effect of the US house price bull market (figure 4). Afterwards, stock prices started to boom again, and house prices continued to rise. The related appreciation of real as well as of financial wealth stimulated demand. At the global level, also commodities prices boomed. This "great moderation" let many economists believe in a stable capitalistic development without inflation and (financial) crises.

Figure 4: Bulls, bears and the financial crisis of 2008

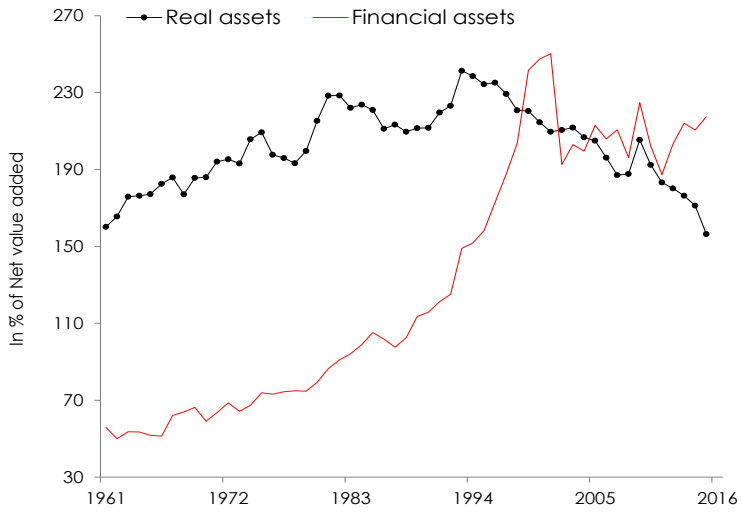


Source: Standard & Poors, Case-Shiller

However, the three bull markets just paved the way into the three subsequent bear markets. For the first time since 1929, house prices, stock prices and commodities prices declined almost simultaneously (figure 4). The negative wealth effects caused demand – nationally as well as globally – to decline strongly and banks' balance sheets to shrink, thereby wiping out their equity. Hence, the "synchronized" three bear markets can be conceived as the most important systemic cause of the financial crisis of 2008.

The third channel through which asset price dynamics affect the real economy concerns the incentive conditions for real relative to financial investments. Stable financial conditions as in the 1950s and 1960s focused striving for profits to activities in the real economy as the latter yielded much higher returns than financial investments. This incentive effect was particularly pronounced in Europe, where also stock markets were "sleeping" (in contrast to the US). In Germany, e.g., the value of real assets (machinery, buildings, etc.) of non-financial business was roughly three times higher than the value of its financial assets. Over the 1970s, real accumulation of the business sector was dampened twice during the recessions of 1973 and 1979 (figure 5). Since the early 1980s, the value of its financial assets rose much faster than the value of its real assets, the former exceeding the latter over the past 25 years (figure 5).

Figure 5: Real and financial accumulation of non-financial business in Germany



Source: destatis, Bundesbank

The shift from real-capitalistic to financial-capitalistic incentive conditions necessarily has dampened economic growth: On the one hand, financial speculation became more attractive, and on the other hand, real investments became more uncertain and riskier. The two most important consequences of insufficient real capital formation were: First, the creation of "good" jobs has been slowing down, i.e., jobs which are equipped with a substantial amount of capital. Instead, more and more working poor jobs were created which need only little capital equipment. Second, the fiscal stance has been deteriorating as lower economic growth necessitates higher social expenditure, particularly for unemployed and working poor, and yields lower tax returns at the same time.

Financial instability has not only contributed to the long-term development of important economic components of the Permacrisis but also to its most important ecological component.

Schulmeister (2023) demonstrates in detail why the fluctuations of fossil energy prices and of carbon emissions permit prices impede an efficient carbon pricing. This is so because the latter would call for steadily rising carbon emission costs, and, hence, for steadily and reliably rising fossil energy prices as well as carbon prices. Only under this condition can profits of investments into reducing emissions be calculated (their most important component consists of the avoided costs of fossil energy and of emission permits, respectively). Over the long run, this condition does not hold due to bull and bear markets of fossil energy prices as well as of carbon permit prices. But even over the short run when neither a bullish nor a bearish regime dominate, carbon prices fluctuate much too much to provide a minimum of planning security (figure 6). The main reason for this instability is once again short-term speculation, in this case in the carbon permit futures markets (Schulmeister, 2023).

Figure 6: Fluctuations of the futures price of EU CO_2 emission allowances

Source: Intercontinental Exchange (ICE)

3. "Bull-Bear-Hypothesis" versus "Efficient Market Hypothesis"

The "efficient market hypothesis" (EMH) still serves as the reference model of asset price dynamics. According to the EMH, asset prices are determined by the respective equilibrium conditions, i.e., the "market fundamentals". The "pure" benchmark model is an ideal, frictionless market where all participants are equipped with perfect knowledge and where no transaction costs exist ("world 0").

The EMH model relaxes the assumptions of perfect knowledge and of no transaction costs. Also, in this "world I", actors are fully rational but do not know the expectations of other actors. Hence, prices can reach a new equilibrium only through a gradual price discovery process,

driven by rational and therefore stabilizing speculation (Friedman, 1953). Any (temporary) deviation of asset prices from their fundamental equilibrium is due to exogenous shocks. The emergence of news and shocks follows a random walk and so do asset prices. Therefore, speculation techniques based on past prices cannot be systematically profitable (otherwise the market would not even be "weakly efficient" – Fama, 1970).

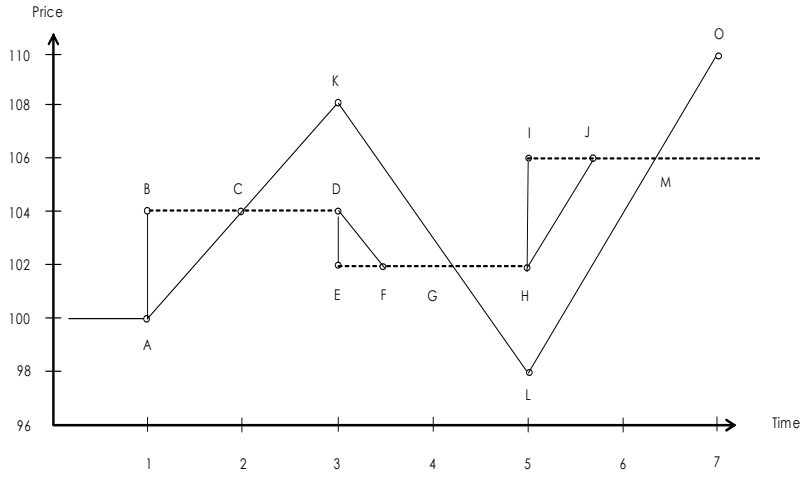
The "bull-bear-hypothesis" (BBH) perceives trading behaviour and price dynamics in asset markets differently ("world II"). Imperfect knowledge and uncertainty are fundamental conditions of social interaction. Therefore, market actors use different models and process different information sets. Their expectations are governed not only by rational calculations, but also by emotional and social factors. In addition, they are mostly formed only qualitatively, i. e., as regards the direction of an imminent price movement.

Upward (downward) price movements are triggered by news and then lengthened by "cascades" of buy (sell) signals stemming from trend-following technical trading systems. When the trend loses momentum, "contrarian models" produce sell (buy) signals which contribute to a change in the direction of the price movement.

The trending behaviour of asset prices is fostered by the dominance of either a "bullish" or a "bearish" bias in expectations. News which are in line with the prevailing "market sentiment" gets higher reaction than news which contradict the "market mood". Therefore, price runs in line with the "market mood" last longer than counter-movements. In such a way short-term runs accumulate to long-term trends, i. e., bull markets and bear markets.

The more an asset becomes over(under)valued ("overbought" or "oversold" in traders' jargon), the stronger become counter forces leading to a change in the market sentiment and finally to a tilt in the direction of the long-term trend (in this way, market fundamentals do matter).

Figure 7: Three stylized paths of asset prices



The sequence of bull and bear markets shapes the pattern of long-term asset price dynamics: Prices develop in irregular cycles around the fundamental equilibrium without any tendency to converge towards this level. It represents rather a "centre of gravity" or an "attractor" (as in the theory of "chaotic systems").

Three (stylized) paths of asset prices clarify the differences between the EMH and the BBH (figure 7):

- In "world 0", new information at t = 1 causes the asset price to jump instantaneously from the old equilibrium at P = 100 (point A) to the new equilibrium at P = 104 (B). In t = 3, news causes the price to jump to P = 102 (at E), and in t = 5 the price jumps to P = 106 (at I).
- In "world I", it takes a series of transactions to move the price from P = 100 to P = 104 (from A to C). Since traders are rational, the movement will stop at the new fundamental equilibrium level and stays there until t = 3, when a new adjustment process takes off.
- In "world II", traders form their expectations also according to the most recent price movements, i. e., when prices move persistently up (down) they expect the respective short-term trend to continue. Hence, they buy (sell) when prices are rising (falling), causing the price to overshoot (from C to K, from G to L, and from M to O).

Profit-seeking traders will try to systematically exploit the trending in asset price dynamics through developing trend-following as well as contrarian strategies so that the conditions of "world II" will almost inevitably emanate from those of "world I": If prices move smoothly from one fundamental equilibrium to the next, then actors will develop trading systems to exploit this trending behaviour since they know that nobody knows exactly the "true" level of fundamental equilibria. Such trading rules based on price charts or on arithmetic transformations of price data have been developed for almost 200 years ("technical analysis"). Over the past 30 years, the trading algorithms have become more complex due to the digital revolution. All these trading strategies process only the information contained in most recent price movements, and, hence, disregard market fundamentals.

4. Short-term trending of asset prices and the role of technical trading

Technical analysis tries to exploit price trends ("the trend is your friend"). Hence, these trading techniques derive buy and sell signals from the most recent price movements which (purportedly) indicate the continuation of a trend or its reversal (trend-following or contrarian models).[1] Since "technicians" believe that the pattern of asset price dynamics as a sequence of trends interrupted by "whipsaws" repeats itself across different time scales, they apply technical models to price data of almost any frequency.

According to the timing of trading signals, one can distinguish between trend-following strategies and contrarian models. Trend-following systems produce buy (sell) signals in the early

[1] Kaufman (2013) and Murphy (1999) provide an overview of the different methods of technical analysis. For a short description of the most important trading rules see Schulmeister, 2009C.

stage of an upward (downward) trend, whereas contrarian strategies produce sell (buy) signals at the end of an upward (downward) trend.

Technical analysis is omnipresent in financial markets (see, e.g., Cheung – Chinn - Marsh, 2004; Irwin-Holt, 2004; Gehrig - Menkhoff, 2006 and 2010; Menkhoff - Taylor, 2007). Many factors have contributed to the popularity of technical trading systems among practitioners. First, these systems can be "universally" used, i.e., they can be applied to any kind of price data frequency. Second, these price data have become easily available. Third, computer hardware and software have become progressively more powerful. Fourth, the internet has enabled traders to trade in real time on all important marketplaces in the world.

Table 1: Components of the profitability of technical trading systems in various asset markets

	Number of models	Gross rate of return per year	Mean of profitability components					
			Profitable positions			Unprofitable positions		
			Number per year	return per day	Duration in days	Number per year	return per day	Duration in days
Stock market, S&P 500 [1])								
1960 - 2007, Spot, daily data	2580	1.5	6.5	0.09	42.1	11.7	-0.15	13.1
1983 - 2007, Futures, Daily data	2580	-3.7	6.5	0.09	40.5	13.5	-0.16	13.3
1983 - 2007, Futures, 30-minutes data	2580	7.2	87.4	0.40	2.6	138.7	-0.59	1.0
Foreign exchange market								
1973 - 1999, DM/dollar rate, daily data [2])	1024	7.9	6.0	0.07	55.0	8.1	-0.09	16.9
1975 - 2007, Yen/dollar rate, daily data [3])	1024	6.9	6.1	0.07	50.7	9.0	-0.09	16.3
1999 - 2006, Dollar/euro rate, 30-minutes data [4])	2466	1.1	139.5	0.31	1.7	223.5	-0.45	0.8
Commodity futures markets, 1989 - 2008 (June) [5])								
WTI crude oil, daily data	1092	12.7	3.3	0.15	84.4	5.7	-0.23	23.0
Corn, daily data	1092	3.8	3.0	0.11	89.8	6.5	-0.17	23.3
Wheat, daily data	1092	2.4	2.9	0.11	87.0	6.7	-0.16	25.0
Rough rice, daily data	1092	12.6	3.1	0.12	94.3	5.7	-0.17	23.5

[1]) Schulmeister (2009C). - [2]) Schulmeister (2006). [3]) Schulmeister (2008B). [4]) Schulmeister (2009D). [5]) Schulmeister (2009A).

- Note: For any single trading system the following relationship holds: GRR = NPP*DRP*DPP-NPL*DRL*DPL, where

GRR	Gross rate of return per year
NPP(NPL)	Number of profitable (unprofitable) Position per year
DRP(DRL)	Return per day during profitable (unprofitable) positions
DPP(DPL)	Duration of profitable (unprofitable) positions in days

Figures 1 and 8 show how the simplest moving average (MA) models operate in the oil futures market and in the dollar/euro market, respectively. The trading rule is as follows: Buy (go long)

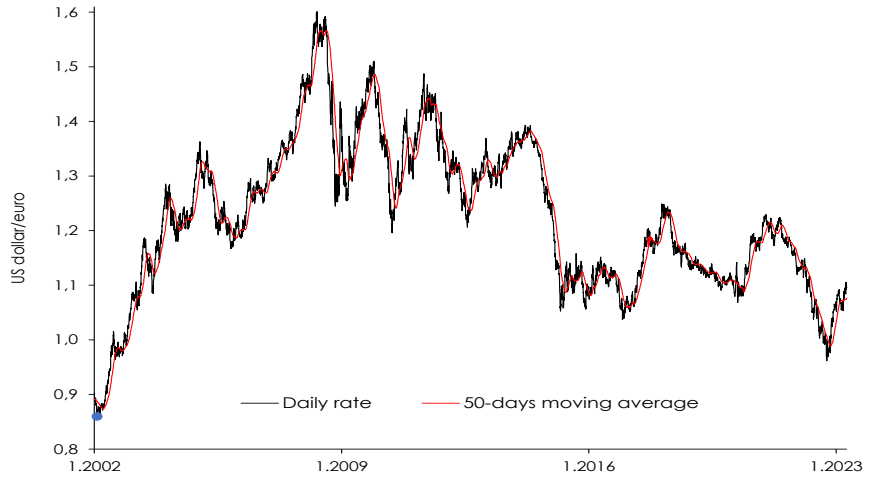
when the current price crosses the MA from below and sell (go short) when the converse occurs (if a model uses two moving averages, then their crossing indicates a trading signal). The figures show that even these simple rules can exploit asset price trends, however, during "whipsaws" they produce a series of losses.

There exists a general pattern in the profitability of technical trading systems (table 1):

- The number of profitable positions is always smaller than the number of unprofitable positions.
- The average return per day during profitable positions is lower than the average return (loss) during unprofitable positions.
- The average duration of profitable positions is several times greater than that of unprofitable positions.

This pattern characterizes technical trading in general (for a detailed analysis see Schulmeister, 2008A, 2008B, 2009B, 2009C): Make profits from the exploitation of relatively few persistent price trends and limit the losses from many small price fluctuations ("cut losses short and let profits run").

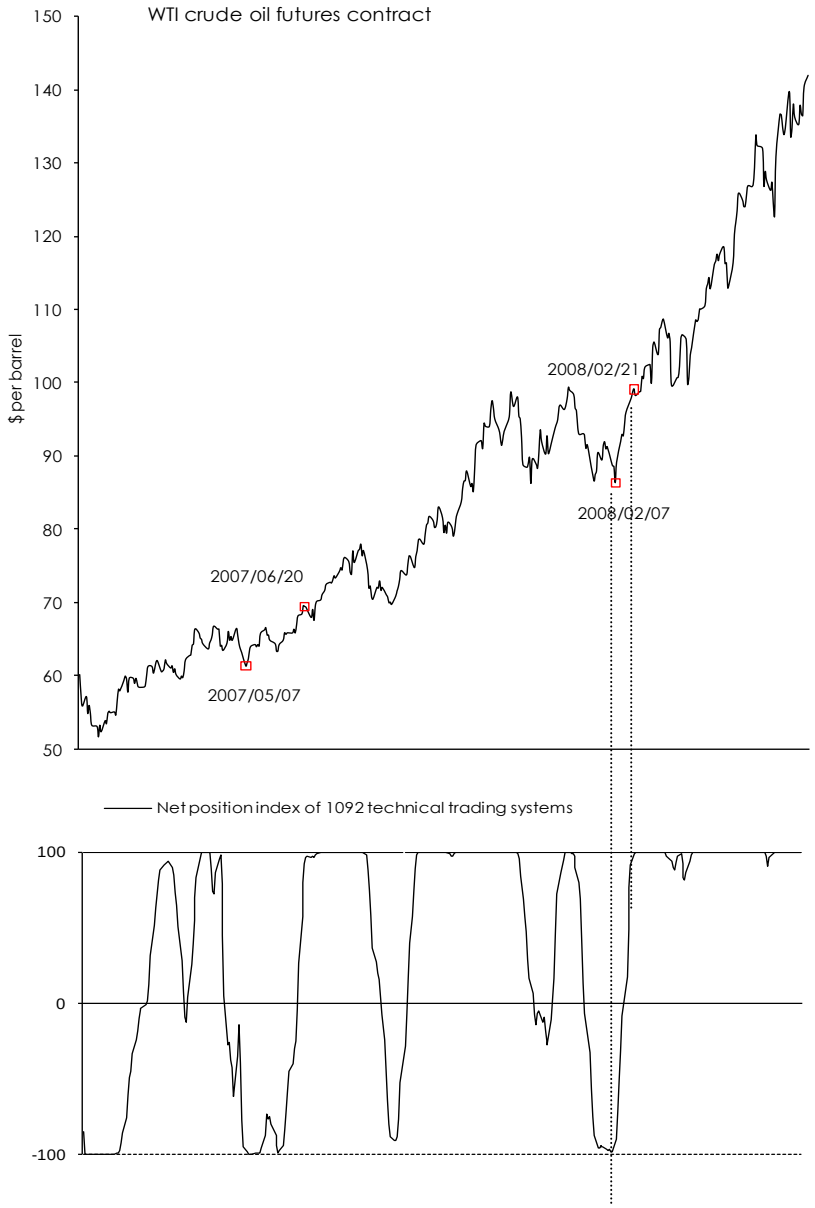
Figure 8: Trending and speculation in the US dollar/euro market



Source: ECB

There operates an interaction between the trending of asset prices and the use of technical models. On the one hand, many different models are used by individual traders, on the other hand the aggregate behaviour of all models strengthen and lengthen price trends. Figure 9 documents this interaction; it compares the change in the aggregate position of 1092 technical models in the oil futures market (NYMEX) between January 2007 and June 2008 to the movements of the oil futures price (a value of +100/-100 of the net position index means that 100% of the models hold a long/short position).

Figure 9: Aggregate trading signals of 1092 technical models and the dynamics of oil futures prices, January 2007 to June 2008



Source: Schulmeister (2009A)

Figure 9 shows the gradual adjustment of technical models to price movements. On February 7, 2008, e. g., all models hold a short position due to a preceding decline in oil futures prices. The subsequent price rise causes the models to gradually switch their position from short to long, the "fast" models at first, the "slow" models at last. On February 21, all models hold a long

position. During this transition period from short to long, technical models exert an excess demand on oil futures since any switch implies two buy transactions, one to close the (former) short position, and one to open the (new) long position.

Studies on the aggregate trading behaviour of the many different models, based on daily as well as on intraday data and operating in different markets reveals the following (Schulmeister, 2006, 2009A, 2009C, 2012):

- Most of the time the great majority of the models is on the same side of the market.
- The process of changing open positions usually takes off 1 to 3 days after the local futures price minimum (maximum) has been reached.
- It takes between 10 and 20 trading days to gradually reverse the positions of (almost) all models if a persistent price trend develops.
- After all technical models have adjusted their open positions to the current trend, the trend often continues for some time.

One can therefore conclude that the widespread use of technical trading systems strengthens short-term asset price trends ("runs").

5. From short-term trends to bull and bear markets

This section investigates the relationship between the following two phenomena:

- Stock prices, exchange rates and commodity prices move in a sequence of upward and downward trends which last for several years (bull and bear markets).
- Asset trading has become progressively "faster", mainly due to the use of algo trading based on intraday data. Consequently, transaction volume has expanded enormously.[2]

The coincidence of both developments constitutes a puzzle. How can very short-term transactions generate asset price movements which accumulate to long-term trends? The "Gestalt" of asset price movements indicate a hypothetical answer (see figures 1, 2, 3, 4, 6, 8):

- Over the short run, asset prices fluctuate almost always around "underlying" trends.
- The phenomenon of trending repeats itself across time scales. However, the volatility of fluctuations around the trend rises with the data frequency (Schulmeister, 2009D).

[2] Already in 2012, the volume of financial transactions in Europe amounted to roughly 120 times (nominal) GDP, in the USA it had declined from 106 times GDP (2008) to roughly 75 times (2012), mainly due to the Frank-Dodd Act which aimed at limiting speculation in reaction to the financial crisis of 2008 (Schulmeister, 2015, fig. 11). However, these data underestimate the actual volume of transactions as they do not include trading CDS (credit default swaps) and "repos" (repurchasing agreements). Since 2012, transactions volume must have expanded further, mainly due to the unprecedented expansion of trading on "dark pools", the preferred marketplace of big players trading large blocks of stocks and other assets (as high frequency traders). However, as data on dark pool transactions are not publicly available, one cannot quantify the recent rise in the volume of overall financial transactions (for dark pools see Shorter – Miller, 2014)

- Over the long run, asset prices move in a sequence of upward and downward trends lasting several years in most cases ("bulls and bears").

These observations suggest that the pattern of asset price dynamics is shaped by the phenomenon of self-similarity: Very short-term price trends ("runs") based on high frequency data are embedded into comparatively longer-term trends based on data of lower frequency and so on. A bull market or bear market would then be the result of short-term upward (downward) trends lasting longer than counter-movements over an extended period.

To examine this hypothesis, the following exercise was carried out. First, the most pronounced bull markets and bear markets are identified which occurred over the 1990s and 2000s in the stock market (S&P 500), in the foreign exchange market (dollar/euro rate) and in the oil futures market (NYMEX). Then it is elaborated how the sequence of monotonic movements ("runs") of daily asset prices brings about long-term trends.

Table 2: Asset price runs during "bull markets" and "bear markets"
Based on daily prices

			Upward runs			Downward runs		
			Number	Average duration in days	Average slope [1])	Number	Average duration in days	Average slope [1])
S&P 500								
23/11/1994	24/03/2000	↑	319	2.35	7.28	318	1.87	-7.38
24/03/2000	07/10/2002	↓	167	1.73	12.92	168	2.05	-12.93
07/10/2002	09/10/2007	↑	341	2.04	7.08	341	1.65	-7.43
09/10/2007	09/03/2009	↓	103	1.69	15.93	103	1.74	-20.41
09/03/2009	19/01/2010	↑	57	2.25	10.28	57	1.56	-9.63
Dollar/euro exchange rate								
01/01/1999	26/10/2000	↓	113	1.79	0.47	113	2.38	-0.48
31/01/2002	30/12/2004	↑	209	1.96	0.56	209	1.66	-0.51
30/12/2004	14/11/2005	↓	57	1.74	0.53	58	2.16	-0.57
14/11/2005	22/04/2008	↑	168	2.03	0.49	167	1.65	-0.45
22/04/2008	27/10/2008	↓	31	1.74	0.71	32	2.31	-0.97
18/02/2009	03/12/2009	↑	57	1.81	0.88	57	1.68	-0.69
Oil futures prices (NYMEX) [2])								
21/12/1998	20/09/2000	↑	101	2.51	1.44	100	1.76	-1.43
20/09/2000	19/11/2001	↓	72	1.99	2.15	73	1.95	-2.68
19/11/2001	17/07/2006	↑	296	2.12	3.18	295	1.73	-3.43
17/07/2006	19/01/2007	↓	33	1.70	2.74	33	2.15	-4.01
19/01/2007	15/07/2008	↑	102	2.02	4.98	101	1.74	-4.07
15/07/2008	19/02/2009	↓	39	1.44	7.48	40	2.45	-8.43
19/02/2009	23/10/2009	↑	46	2.24	2.87	45	1.56	-3.12

Source: Own calculations; see Schulmeister, 2009A and 2009D. The sign ↑/↓ indicates bull/bear markets. [1]) Average change in price level per day. - [2]) Most traded (front month) contract.

The tripling of stock prices between November 1994 and March 2000, their doubling between October 2002 and October 2007 as well as the rise by roughly 70% between March 2009 and January 2010 was mainly due to upward runs lasting on average by one third longer than downward runs, the average slope of upward and downward runs was roughly the same (table 2). In the same manner, the bull market of the dollar/euro exchange rate and of oil futures prices were primarily brought about by upward runs lasting longer than downward runs.

The picture is somewhat different for bear markets. As the speed of price movements is generally greater during "bears" as compared to "bulls", the differences in the slope of upward and downward runs contribute to a greater extent to the overall price change during bear markets than during bull markets. However, also the persistence of price movements matters: During "bear markets", downward runs last on average by one third longer than upward runs.

Table 3: Asset price runs during "bull markets" and "bear markets"
Based on 5-days moving averages of daily prices

			Upward runs			Downward runs		
			Number	Average duration in days	Average slope [1])	Number	Average duration in days	Average slope [1])
S&P 500								
23/11/1994	24/03/2000	↑	122	6.90	3.31	122	4.08	-3.52
24/03/2000	07/10/2002	↓	62	4.32	5.25	63	5.75	-5.79
07/10/2002	09/10/2007	↑	130	5.55	3.19	129	4.12	-2.93
09/10/2007	09/03/2009	↓	39	3.74	5.23	40	5.08	-8.01
09/03/2009	19/01/2010	↑	24	5.79	4.75	24	3.08	-3.27
Dollar/euro exchange rate								
01/01/1999	26/10/2000	↓	44	3.80	0.23	45	6.64	-0.24
31/01/2002	30/12/2004	↑	70	6.77	0.24	68	4.06	-0.24
30/12/2004	14/11/2005	↓	25	3.36	0.23	26	5.23	-0.27
14/11/2005	22/04/2008	↑	59	6.29	0.24	58	4.17	-0.19
22/04/2008	27/10/2008	↓	11	3.91	0.36	12	6.75	-0.54
18/02/2009	03/12/2009	↑	24	5.13	0.36	23	3.13	-0.28
Oil futures prices (NYMEX) [2])								
21/12/1998	20/09/2000	↑	36	7.64	0.70	35	4.29	-0.56
20/09/2000	19/11/2001	↓	30	4.40	0.89	28	5.14	-1.19
19/11/2001	17/07/2006	↑	98	6.81	1.42	98	4.73	-1.55
17/07/2006	19/01/2007	↓	11	3.27	1.14	12	7.25	-1.84
19/01/2007	15/07/2008	↑	40	5.95	2.18	39	3.59	-1.66
15/07/2008	19/02/2009	↓	12	2.83	3.08	13	8.92	-4.07
19/02/2009	23/10/2009	↑	17	6.41	1.37	16	3.75	-1.31

Source: Own calculations; see Schulmeister, 2009A and 2009D. The sign ↑/↓ indicates bull/bear markets. [1]) Average change in price level per day. - [2]) Most traded (front month) contract.

The accumulation of monotonic price movements to long-term trends is particularly pronounced based on 5-days moving averages of the original price series (table 3). This is not surprising: Since there prevails almost always an "underlying" trend, smaller counter-movements are smoothed out even by a short moving average. For example, during the "internet bull market" between November 1994 and March 2000, there occurred 637 runs based on the original S&P 500 data, but only 244 based on 5 days moving averages. Out of the latter, upward runs lasted on average 6.9 days, downward runs 4.1 days (table 3).

The main (statistical) reason for why upward (downward) asset price runs last on average longer during bull (bear) markets is the following: During a bull (bear) market there occur significantly more persistent, i.e., long lasting, upward (downward) runs than expected under the EMH. The main (behavioural) reason for this phenomenon is the following: When the direction of a short-term trend is in line with the prevailing market sentiment ("bullishness" or "bearishness", respectively) then traders put more money in their speculative position and hold it longer than during "counter-movements". At the same time, this behaviour strengthens the trending of asset prices and, hence, the attractiveness of technical trading strategies.

6. Transition from continuous trading to electronic auctions as means of stabilizing asset markets

So far, the following stylized facts have been elaborated about causes and consequences of asset price instability over the short run as well as over the medium and long run:

- All important financial asset prices like exchange rates, stock prices or commodities prices move in a sequence of bull and bear markets, and hence, in long-term irregular cycles.
- This "overshooting" dampens the real economy through changes in in the global income distribution, through changes in the real burden of (dollar) debts, through changes in the valuation in financial wealth, through related financial crises and through shifting striving for profits from activities in the real economy to financial speculation.
- The wide fluctuations of fossil energy prices as well as of carbon emission prices prevent anchoring the expectation that the effective costs of carbon emissions will rise steadily, and hence, that investments in emission reductions will be reliably profitable.
- Bull (bear) markets are brought about in the following way: When a bullish (bearish) market sentiment prevails short-term upward (downward) price trends last a little bit longer than counter-movements, causing the asset to appreciate (depreciate) in a stepwise process.
- Turning points in price movements are triggered by news inducing trend-following systems to produce a series of buy (sell) signals. This lengthens the trend so that finally also amateur traders follow. When the trend loses momentum, contrarian systems produce sell (buy) signals which together with some news trigger a tilt into a new downward (upward) trend.
- The phenomenon of trending repeats itself across time scales. It is strengthened by the widespread use of technical trading systems based on different data frequencies.

- The less market fundamentals are taken into consideration in asset trading (as with all types of technical or algo models), the greater is the extent of price overshooting. It is greatest when an intrinsic asset value does not even exist as in the case of crypto currencies.

It follows from this "diagnosis" that mitigating the extent of asset price "overshooting" calls for restricting short-term trending since "mini-runs" accumulate to short-term trends which finally accumulate to bull and bear markets. This could be done in two different ways.

First, one could make short-term speculation less profitable by burdening the (notional) value of any financial transaction with a small tax (e.g., between 0.01% and 0.1%). Such a FTT would raise trading costs the more the faster transactions are carried out and the riskier they are (i.e., the higher is the leverage ratio in the case of derivatives trading). For example, if stocks or bonds are bought (sporadically) for holding them, an FTT of 0.01% or even 0.1% does not matter. If, however, a trading system carries out thousands of transactions per day to profit from minuscule price differences (as is the case with high frequency trading), then even a tax rate of only 0.01% would render the whole business unprofitable (for the concept of a general FTT see Schulmeister et al., 2008, and Schulmeister, 2015).

The second approach is theoretically more appealing, technically easy to implement and has so far not seriously been discussed: Moving from continuous trading in milli- or even microseconds to electronic auctions, e.g., every three hours (three times per – traditional – trading day). Like the FTT approach, the auction approach aims at restricting (super) fast technical or algo trading. However, it is more radical than the FTT approach in the sense that it does not restrict fast trading by making it more expensive but by making it impossible: If auctions are held only every three hours, automated trading systems are cut off their "food", i.e., high frequency price data.

There are several reasons why this idea should be seriously discussed. First, moving to electronic auctions would eliminate all transactions which are completely unrelated to market fundamentals. Second, asset trading would be slowed-down and would become more fundamentals-oriented as compared to the present "high-speed casino". Third, electronic auctions at certain intervals would organize a price discovery or "tâtonnement" process as envisaged by one of the founders of neoclassical economics, Léon Walras.

First, the auction model would eliminate all transactions stemming from automated trading systems which generate price movements from which they profit at the same time: High frequency trading (HFT) systems anticipate large customer's orders through complex algorithms, jump in front of them through buying the assets and resell them within milli- or even microseconds to the customer at a miniscule higher price ("frontrunning").[3] Traditional trading systems based on tick, minute or hourly data transform small price movements into short-term

[3] The types of high frequency trading and the related challenges for regulatory policy are documented in Shorter – Miller, 2016; Virgilio (2019) provides a survey of the literature on high frequency trading.

trends from which they profit at the same time.[4] As HFT as well as traditional technical trading generate liquidity which destabilizes asset prices, eliminating this excessive liquidity would reduce market inefficiency (liquidity per se is not a value in itself).

Second, replacing continuous trading with electronic auctions would shift the focus of trading to reducing the difference between the actual price and the expected fundamental equilibrium (as assumed by the EMH). A simple example illustrates this argument. Suppose a trader is specialized in Apple shares. He uses all available sources about firm-specific fundamental factors like (potential) innovations, marketing strategies, profit expectations, etc., about macroeconomic factors like expected GDP growth etc., and watches also different technical trading systems. Even if he personally does not believe in these algorithms, he must take them into account as many other traders subscribe to them (Keynes' famous "beauty contest problem" – Keynes, 1936, p. 156). Suppose his fundamental analysis leads our trader to believe that the Apple stock is significantly overvalued. However, when the price starts to rise and (fast) trading systems produce buy signals, he would also buy to profit from the trend. However, if trading were restricted to electronic auctions, short-term trends can no longer be observed. At the same time, any trader must quantitatively gauge the extent of over- or undervaluation of the respective asset as basis for his orders for the subsequent auction.

This example points at an extremely important feature of (modern) asset markets: Trading is based on only *qualitative* expectations concerning the direction of imminent price *movements* (and not on *quantitative* expectations concerning the equilibrium or fundamental price *level*). If news hit the market, e.g., that Pfizer acquired a new patent or that the trade deficit of the US rose stronger than expected, traders will expect Pfizer share price to rise and the dollar exchange rate to fall without quantifying the extent of the imminent price movement. The reason is simple: There is not enough time and information to quantify how strongly the Pfizer share price will rise, or the dollar exchange rate will fall and within which time. For making profits it is in most cases sufficient to catch the direction of the imminent price movement.

The same is true for all technical trading strategies, chartism as well as algorithmic models. For example, so-called "support lines" or "resistance lines" (purportedly) only indicate a continuation or a reversal of a prevailing price trend. In the case of moving average models, momentum models or any other traditional (quantitative) technical model, a buy signal, e.g., only implies that in most cases one will make a loss when following the signal (the number of single losses always exceeds the number of single profits – table 1). However, persistent trends occur sufficiently often (even though one cannot know when) so that the profits from their exploitation overcompensate the smaller losses from "whipsaws", i.e., smaller price fluctuations.

Whereas in the world of (super) fast continuous trading, it is a waste of time to gauge the fundamental equilibrium level of an asset price, it would pay off to do so in the world of electronic auctions: The better one can approximate the extent of over- or undervaluation of

4) Figure 9 shows that when most simulated trading systems hold already a position in line with the current trend, the latter continues for some time, probably due to some "late coming bandwagonists" who – as a group – are the losers in this "game".

an asset, the more profitable his auction orders will be. Also, other traders will have to focus on market fundamentals. Hence, when forming expectations about other traders' expectations ("beauty contest problem") fundamental factors will matter much more than "technical" factors.

Clearly, if three prices would be determined by electronic auctions per trading day, one could still apply technical trading systems based on the respective price series. However, as the speed of technical trading would be so much slower as compared to continuous trading, one need not and will not blindly follow the trading signals as in the case of high-speed automated systems. Hence, one will take (also) fundamental factors into account.

The third argument in favour of moving from continuous trading to electronic auctions concerns auctions as a general method of organizing a fundamentals-oriented price discovery process, i.e., as a means of approximating the "true" equilibrium price under "real world conditions" (uncertainty, risk, non-rational factors and their "bundling" to herding effects, etc.). In the context of asset prices, it is specifically important to shift the focus of expectations formations from "noise" to the market fundamentals.

Technically, such auctions are easy to implement, they would be conducted on electronic trading platforms in the same manner as the opening price is determined already today on organized exchanges: The computer calculates the equilibrium price based on all buy and sell orders, valid for the following three hours.

At first glance, one could argue that such an auction model weakens market efficiency insofar as prices cannot react to news right away but only at the next following auction. Since immediate price movements to news almost always overreact (because traders must react as fast as possible without knowing the new equilibrium level), the slow-down of trading provides the time necessary to evaluate the possible price effect of all news which have hit the market since the last auction.

For all people who want to buy or sell stocks, bonds, foreign exchange etc. for business purposes or for personal reasons, it is sufficient to be able to do so every three hours. Hence, they would not be affected by replacing continuous trading with electronic auctions. By contrast, the environment of professional trading would change substantially: The many monitors for watching price movements at different data frequencies and the respective trading signals produced by different algorithms would become superfluous. At the same time, the ability to gauge the "true" value of an asset based on an analysis of its fundamental factors, would become the most important prerequisite for successful trading.

Even though the idea to organize the asset price discovery process as electronic auctions is based on the empirical evidence of continuous trading over decades, it will hardly be discussed seriously very soon. The main reason for that is the following: What is "empirically evident" depends on the perception of the observer and, hence, on the theory he/she subscribes to. This in turn depends on the "Weltanschauung" or "paradigm" which dominates

in academia, media, and politics: Once a paradigm has been established, facts which fundamentally contradict the paradigm remain mostly unseen or are suppressed.

This issue was first analysed in 1935 by Ludwik Fleck in his pathbreaking, yet for decades neglected monograph "Genesis and Development of a Scientific Fact":[5] "Once a structurally complete and closed system of opinions consisting of many details and relations has been formed, it offers enduring resistance to anything that contradicts it……1) A contradiction to the system appears unthinkable; 2) What does not fit into the system remains unseen; 3) alternatively, if it is seen, either it is kept secret, or 4) laborious efforts are made to explain an exception in terms that do not contradict the system……" (Fleck, 1981, p. 27).

Since the late 1960s, general equilibrium theory completed with the assumption of "rational expectations" has been re-established in economics as a "structurally complete and closed system of opinions". Fleck calls such a system "harmony of illusions" (Fleck, 1981, p. 27), an expression which condensates the essence of the general equilibrium theory in two terms. Embedded in this model is the theory of the efficiency of financial markets which implies two assumptions: First, the prices of assets reflect their fundamental value, and second, speculation systems based only on the information contained in past prices cannot be profitable (otherwise the market would not even be "weakly efficient" (Fama, 1970).

In line with Fleck's statement 1, it appears "unthinkable" (to mainstream economists) that asset prices move in "long swings" as a sequence of bull and bear markets and that trading rules derived only from past prices are (too) often profitable. Both phenomena would fundamentally contradict the prevailing "thought system": That precisely those markets which come closest to the perfect market of equilibrium theory (as regards market access, transactions costs, etc.) *systematically* generate "wrong" prices, e.g., "overshooting", is "unthinkable" within the paradigm. The same holds true for destabilizing, yet profitable, speculation.

For the same reason, technical trading is never considered as "profit-rational" (though not rational in the sense of "rational expectations") in theoretical models of asset price dynamics - "it does not fit into the system" and, hence, "remains unseen" (in accordance with Fleck's statement 2). In practice, trading rules have been used for more than 150 years but have been ignored also in empirical research (Fleck's statement 3). Only over the past 30 years, have trading systems increasingly been analysed, however, rather as some kind of useless "anomaly" ("noise trading") – although by now they generate most financial transactions (including HFT).[6] Therefore, also the following (dissolvable) contradiction has been neglected: If these models

[5] Thomas S. Kuhn took the most original ideas from Fleck's monography for his bestseller "The Structure of Scientific Revolutions" (1962) as he himself noticed in the introduction ("an essay that anticipated many of my own ideas" - Kuhn 1962, p. VII). However, Kuhn did not quote Fleck's monography in the main text of his book. An English translation of Fleck's monography was published only in 1979 (including a foreword by Thomas Kuhn - Fleck, 1979).

[6] The same holds for the behavioral finance literature in general which usually takes the EMH as the benchmark model and explores empirical deviations as "anomalies". By contrast, if one follows an inductive approach, then empirical phenomena like bull markets, bear markets, technical trading, etc. appear as characteristic properties of asset market dynamics ("benchmark") and prices oscillating around fundamental equilibria as idealistic imaginations ("anomalies").

are useless, then the assumption of agents' rationality is untenable, if they are (often) profitable, then the assumption of (weak) market efficiency is untenable.

Even though the empirical foundation of the proposal to replace continuous asset trading with electronic auctions contradicts directly the (still) prevailing economic paradigm, its documentation might be useful as part of preparing for a deepening of the present multi-dimensional crisis. As shown in section 2, bear markets can easily trigger a financial crisis via the negative valuation effects. For example, between February 17, 2020, and March 23, 2020, stock prices fell globally like never before in history (within roughly five weeks, the S&P 500 declined by 34% and the MSCI World by 33%). Only through an unprecedented intervention did the most important central banks succeed in stopping the decline and in convincing the "big players" to get back into the market (at much lower prices). As result, the "fastest" bear market tilted into a mega bull market (stock prices more than doubled when the real economy suffered its deepest decline since 1945 due to Covid19). A more recent example is the balance-sheet contraction of US banks caused by falling bond prices which in turn were caused by rising interest rates. Also in this case, policy had to intervene and thereby had to break its own rules.

Despite these turbulences, it seems still premature to deal with the technicalities of organizing electronic auctions. The respective guidelines, however, are clear cut: In each of the three global trading time zones (Asia and Pacific, Europa, America) there should operate one single and common exchange for each type of standardized assets. These comprise all assets already traded on organized exchanges like stocks, bonds, commodities derivatives and carbon emission permits as well as standardized assets which at present are still traded primarily over the counter like currencies (customized OTC instruments need not to be traded in the form of electronic auctions as these instruments are not used for "fast" algo trading). "Dark pools" should be closed and other types of segmentation of markets for standardized assets need to be avoided.

7. Conclusions

Economic development over the last 50 years has been shaped by a structural financial instability. Its most important systemic component concerns asset price dynamics: Exchange rates, stock prices, commodities prices and bond prices move in a sequence of bull and bear markets, and hence, in long-term irregular cycles (in contrast to the 1950s and 1960s when financial markets were largely regulated).

This "overshooting" dampens the real economy through three channels: Through shifts in in the distribution of income from international trade (distribution channel), through changes in the real burden of international (dollar) debts and changes in the valuation of equity wealth as stocks, bonds, commodities, real estate etc., as well as through the related financial crises (valuation channel), and through shifting striving for profits from activities in the real economy to financial speculation (incentive channel).

In addition, the bull and bear markets of fossil energy prices as well as of carbon emission prices impede fighting global heating because they prevent anchoring the expectation that the effective costs of carbon emissions will rise steadily.

Bull (bear) markets are the result of the accumulation of short-term price trends lasting longer than counter-movements over an extended period. Short-term upward (downward) price movements are usually triggered by news and then lengthened by "cascades" of buy (sell) signals stemming from trend-following technical ("algo") trading systems. When the trend loses momentum, "contrarian models" produce sell (buy) signals which contribute to a change in the direction of the trend. Short-term trending repeats itself across different time scales due to use of algo trading systems based on different data frequencies (from tick data to daily data). Nowadays most financial transactions are triggered by automated trading systems which completely disregard market fundamentals (as all kinds of technical trading systems).

In asset markets most of the time there dominates either a "bullish" or "bearish" expectational bias. News in line with the prevailing market sentiment trigger more persistent price runs than oppositional news. In such a way short-term runs accumulate to bull markets and bear markets. The more an asset becomes over(under)valued, the stronger become counter forces leading to a change in the market sentiment and finally to a tilt in the direction of the long-term trend (in this way, market fundamentals do matter). Hence, asset prices move in irregular cycles around their fundamental equilibrium without any tendency to converge towards this level.

Dampening the "long swings" of asset prices calls for eliminating those (fast) transactions which strengthen short-term trending, and which are completely unrelated to market fundamentals, i.e., all transactions exclusively triggered by technical trading systems. This type of liquidity does not enhance the "price discovery process" but the "price distortion process".

A financial transactions tax could serve this purpose by making "fast" algo trading unprofitable. However, there is an alternative approach which is theoretically more appealing, technically easy to implement, and which has so far not seriously been discussed: Replacing continuous trading in milli- or even microseconds with electronic auctions, e.g., every three hours. In this way, practically all types of (super) fast technical or algo trading systems could no longer be applied as they are cut off their input, i.e., the most recent high frequency price data. Asset trading would be slowed-down and would become more fundamentals-oriented because traders need to consider market fundamentals when placing their orders for the auction.

Clearly, for now the idea to move from continuous asset trading to electronic auctions appears utopian at best. However, once the economic as well as the ecological unsustainability of the prevailing system of asset price formation will become evident during a deepening of the present multi-dimensional crisis, discussed in this volume with the concept of Permacrisis, a serious discussion of the empirical foundation of this idea might help as one step into the right direction. At the end of a dead end, one must turn around.

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