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► **To cite this version:**

| Michaël Assous. ”Corridor stability” in early history of macroeconomics. 2024. ensl-04604537

**HAL Id: ensl-04604537**

**<https://ens-lyon.hal.science/ensl-04604537>**

Preprint submitted on 7 Jun 2024

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# “Corridor stability” in early history of macroeconomics<sup>1</sup>

June 4, 2024

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In his 1973 “Effective Demand failures” article, Axel Leijonhufvud proposed moving beyond the division between the two “cosmologies” that characterized the 20th century. The first, allegedly represented by most neoclassical models, presented a view of the world where any deviation of the economy from its stationary equilibrium would immediately trigger “deviation-counteracting feedback control mechanisms.” The larger the deviation, the stronger the “homeostatic” tendencies would be in bringing the system back to equilibrium. In contrast, the second cosmology, encapsulated in most Keynesian models, assumed no “automatic” tendency for the economy to converge to this equilibrium. The economy could settle anywhere between zero and full employment, with all “servo-mechanisms” idle. Moreover, when displaced by shocks from a previous position, the system was

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<sup>1</sup> The author gratefully acknowledges one anonymous referee for his useful comments and references as well as the participants in the Workshop held in Nice in honor of Richard Arena on May 19th 2022, where an earlier version of this article was presented.

assumed to exhibit endogenous tendencies that would amplify the displacement instead of counteracting it.

Leijonhufvud introduced the concept of "corridor stability" as a way of reconciling these two opposing views of the world. It suggests that the economic system is likely to behave differently for large displacements from its stationary equilibrium compared to moderate ones. Within a certain range, homeostatic mechanisms would work effectively, resulting in stronger deviation-counteracting tendencies. Outside of this range, these tendencies would weaken, and the system would become increasingly prone to "effective demand failures." If the system is displaced far enough, the forces working to bring it back to equilibrium may be so weak and sluggish that the Keynesian "unemployment equilibrium" model would be a sensible representation of its state. So, inside the corridor, multiplier effects would be weak and dominated by neoclassical market adjustments, while outside the corridor, they would be strong enough to endogenously amplify the effects of shocks on the prevailing state. "Finally, although within the corridor market forces would be acting in the direction of clearing markets, institutional obstacles of the type familiar from the conventional Keynesian literature may, of course, intervene to make them ineffective at some point. Thus, a combination of monopolistic wage-setting in unionized occupations and legal minimum-wage restrictions would obviously cut the automatic adjustment process short before 'equilibrium employment' is reached" (Leijonhufvud 1973: 33).

Since the 1970s Leijonhufvud's perspective has struggled to find its way into mainstream macroeconomics. While economists such as James Tobin (1975), Peter Howitt (1978), Bradford De Long, Larry Summers (1986), and others have developed models incorporating corridor stability properties, their impact on macroeconomic

theory and teaching has been limited (Dimand and Gomez, 2024). However, the concept has proven more influential in shaping policy decisions. Policy makers like Ben Bernanke, who served as chair of the Federal Reserve Board during the 2007 Global Financial Crisis, and Mervyn King, who was governor of the Bank of England at the same time, appeared to endorse the notion that certain significant shocks - just think of the Lehman brother bankruptcy - could profoundly disrupt the economy. While they never alluded to Leijonhufvud's works, it is fair to say that their actions speak for themselves.

The concept of the "corridor stability hypothesis" is now firmly associated with Leijonhufvud's name. However, the idea of a stability threshold had already been discussed earlier, as evidenced by seminal works from the early 1930s (Howitt 1979: 266, Dimand, 2005, Assous, 2013). Anyone who needs convincing of this can look at Irving Fisher's classic 1933 *Econometrica* article on debt deflation and think about the importance he attached - with reference to various metaphors - to the existence of a tipping point beyond which the economy may lose its ability to recover its balance. Interestingly, Fisher was not the only one to support this idea. Among his contemporaries, Jan Tinbergen (prior to the publication of Keynes's *General Theory*) was particularly keen on incorporating this vision into a macrodynamic model. In his efforts to explain the prolonged depression of the early 1930s, he published a series of articles on the possibility that a significant shock may lead to an economic collapse (Assous and Carret, 2022, chapter 5). Based on this line of thinking, he developed a macrodynamic model that proved to serve as the foundation for the first large-scale macroeconomic model.

Tinbergen recognized the relevance of macroeconomic models for studying the behavior of the economy under the assumption that it would remain in the vicinity

of its stationary state. He also acknowledged (see Tinbergen, 1938a), but certainly not forcefully enough, that there was a risk with such models of underestimating the possibility for a significant shock displacing the economy from its zone of stability. This was because such models, due to their complexity, had to be linearized to be solved. However, as time passed and new macroeconomic models were developed, economists gradually lost sight of these risks. Consequently, Fisher's vision quickly faded away. It was eventually Leijonhufvud's merit, seemingly unaware of the works of his predecessors, to bring attention back to it.

In this note, my aim is to provide a brief sketch of the way the corridor stability hypothesis was initially integrated into macroeconomic models before being consigned to the background. I will mostly focus on early macroeconomic models and the contributions of Tinbergen, Lawrence Klein and Arthur Goldberger. Although far from complete, I hope to provide a first insight into an aspect of the transformations of the post World War II period which Alain Raybaut and I plan to further detail in our forthcoming book (Assous and Raybaut, 2025).

Richard and I have had many opportunities to talk about the history of macroeconomics since we first met in Nice twenty years ago at the occasion of one of the first ESHET Summer School in History of Economic Thought, Economic Philosophy and Economic History. At that time, I just started my PhD and really enjoyed Richard's ability to offer a fresh view on most issues we had the chance to discuss. Most of our discussions were about the possibility to account for endogenous cycles and the scope of the contributions of Michal Kalecki, Nicholas Kaldor and others. More recently, I became more and more interested in understanding when an economy may collapse. The accumulation of bad news on the environmental front certainly plays a part in this evolution. Anyway, I came to

read Fisher, Tinbergen and others. Richard's opinion may certainly differ from mine. So much the better if this triggers a new round of discussion as fascinating as the first we had two decades ago.

## Corridor stability in early macrodynamic models

A great achievement of Fisher's 1933 article on debt deflation was to identify new economic mechanisms involved in the great depression. Its less tangible but no less valuable contribution was to articulate these mechanisms to a specific vision of the world, a vision Fisher depicted through various metaphors. Take a boat on the sea. In response to moderate perturbations (waves, wind, faulty navigation), one may expect it to remain afloat, moving regularly to the right or the left. What, now, if a large perturbation makes it lean dangerously on either side? Beyond a certain limit, the boat may well capsize and go down. Similarly, a stick may well be bent and regain its initial position but only to a limited degree. Beyond a certain point, it will very likely break up and definitely lose its flexibility. The bottom line for Fisher was that the whole economy, like a boat or a stick, may well return to its equilibrium for small deviations but not for large ones.

Fisher had no intention to build a fully integrated theory in his 1933 article. He rather sought to present his "creed" on the "cycle theory" as a sort of manifesto. This manifesto consisted of 49 paragraphs which could "serve as a challenge to others and as raw material to help them work out a better product" (Fisher 1933: 337). The challenge was open to almost all economists, whether supporters of under-consumption, under-spending, and over-production approaches, as well as to econometricians involved in the development of macrodynamic systems. In sum, his

goal was to stimulate new ways of accounting for the stability or instability of the economy, the rolling or capsizing of the economic ship.

At a time macrodynamics was in its early stages of development - think that in 1933, only Ragnar Frisch and Michal Kalecki had managed to construct a macrodynamic model - this was a considerable challenge. It means - at least for econometricians - to mathematically account for the possibility that the economy may cycle in the vicinity of its stationary state but to move away from it beyond a certain limit. Needless to say that neither Frisch's nor Kalecki's models displayed that feature. Soon, though, Tinbergen managed to build a model meeting Fisher's requirements. It may seem odd to mention his works at this stage. While most historians agree to credit Tinbergen for opening the way toward Frisch's and Kalecki models and building the first large-scale macroeconomic model (Tinbergen, 1939), few have highlighted his remarkable contribution to macrodynamics. However, the fact remains that Tinbergen built a macrodynamic model with specific stability properties (see Dekker 2021, Assous and Carret 2022).

Like Fisher, Tinbergen was eager to account for the great depression and the possibility for the economy to enter a deep phase of depression. His initial model, presented in 1934 in a Dutch journal, demonstrated how changes in structural coefficients could lead to dramatic shifts in the behavior of the economy. On that basis, he soon realized that similar changes in the behavior of the economy could be caused by changes in initial conditions, even with an unchanged structure. This discovery, as revealed in his works from 1935 (Tinbergen 1935a, 1935b, 1935c) and 1936, highlighted that this was due to the existence of a non linearity of the system showing that the economy may converge to its stationary state as long as it remains close to it but could collapse once displaced too far from it.

The model took the rather simple form of an equilibrium condition between what may be called aggregate supply and aggregate demand. Tinbergen showed that there existed in general two positions of equilibrium, so that if the economy was fluctuating around the high equilibrium, an external shock of too great a magnitude could cause it to go over the unstable equilibrium, and “into the abyss” as he wrote somewhat poetically in his 1936 paper.

This behavior is easily reproduced in the following figure, where a change in initial conditions (here represented by a change on prices in period 2,  $p(2)$ ) leads the economy to move away from the stable equilibrium (corresponding to the stationary price equal to 100) to exceed the unstable equilibrium (corresponding to the stationary price equal to  $66 \frac{2}{3}$ ) and plunge toward a zero level (supposed here to be a limit to the evolution of prices)

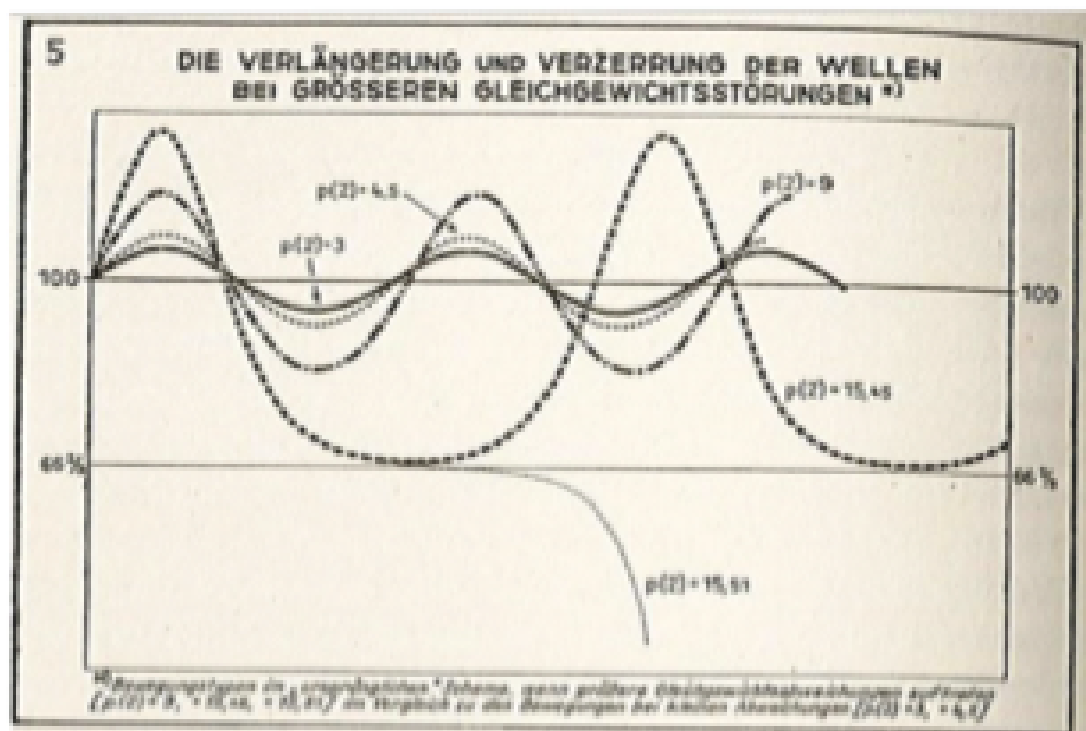




Figure 1. The lengthening and shortening of the waves in the case of major equilibrium disturbances. Source: Tinbergen (1936, 216)

In all the variants of this model studied by Tinbergen, only the low equilibrium was unstable so that shocks, whether positive or negative, proved to be unable to lead the economy on a path of perpetual growth and prosperity. Instead, such shocks, if large enough, were shown to be likely to push the economy into a downward spiral from which it cannot recover. This insight thus challenged the notion that only negative shocks could cause economic collapses. As demonstrated in two articles published in 1935 discussing the effects of Roosevelt's New Deal policy, a once and for all rise of money wages could for instance initially stimulate economic growth and create a period of boom but also, if the magnitude of this rise proved to be too high, destabilize the economy and lead to its collapse. Tinbergen (1938b) subsequently wrote several papers in which he reflected upon the possibility of regulating such instability. Still referring to this model, he argued that economic policy could be used as a "linearization" mechanism ensuring that the economy would not stray too far away from its high equilibrium.

As he explored the properties of this macrodynamic model, Tinbergen was also busy estimating large-scale macroeconometric models for both the Dutch and the US economies. In that context, he found it necessary to work with a linearized version of his system, a decision now mainly driven by a need for simplification. Because he had seriously considered the possibility for an economy to fluctuate in the neighborhood of its stationary state but to cumulatively deviate from it beyond a critical value of some parameters, he knew better than anyone the risks associated with such an estimating method. Despite this awareness, Tinbergen, perhaps driven by his enthusiasm for promoting the development of this approach, did not place

significant emphasis on these risks. The same was true for his immediate followers. Soon, this question was hence pushed aside, and the focus shifted as new macroeconomic models were developed

## Corridor stability in early macroeconomic models

Like Tinbergen, Lawrence Klein was aware that the real world often operates according to nonlinear equations. However, similar to Tinbergen, Klein did not place significant emphasis on the implications of linearizing these relationships. When he constructed the second large-scale macroeconomic model of the US during his time at the Cowles Commission in the mid 1940s, his primary concern was rather to develop new estimation methods and tools that could provide valuable insights and predictions about the behavior of the economy, particularly in the postwar era (Klein 1950: vii). In this context, he prioritized the ability of the model to account for the empirical patterns observed in the US economy, rather than explicitly addressing the possibility for an economy to collapse. It is also the case that at a time when the Great depression became more distant, the idea that the economy may face a risk of global instability moves into the background.

This shift in perception can be seen in the second model he developed in collaboration with his PhD student Arthur Goldberger even if the latter, in a short book published in 1959 (130) cautiously argued that the linearization they made did not create a misleading picture of how the economy functions. To support this argument, he referred to the famous study conducted by Irma and Franck Adelman (which was not yet published at the time of Goldberger's book) who had just shown with the help of an IBM computer that the nonlinear version of their model was stable. Taking 1952 as the year of reference, they in effect traced out the resultant

path of all endogenous variables, year by year, until 2052 and showed that the economy would adjust cyclically to “large shocks” while all endogenous variables would grow at the same rate as exogenous variables after approximately six years. As the Adelmans put it in the published version of their study, “even a very strong shock will not permanently distort the long-run path of the economy. In other words, the Klein-Goldberger system is stable” (Adelman 1959: 606).

The conditions were thus ripe for a return to Ragnar Frisch's explanation of economic cycles as being driven by random disturbances acting on the economic system. By subjecting the Klein-Goldberger model to random disturbances, they were able to extract cycles from the generated economic series that was compatible with the cyclical patterns observed in the development of the United States from 1814 to 1938 with a first cycle of approximately 40 months, similar to the observed business cycle, and a second cycle of around 14 years, similar to the Kuznets cycle. At the end of the day, little was then left of Irving Fisher's vision two decades after the publication of his article.

Interestingly, this shift was reinforced by the development of so-called endogenous business cycle models, which, even if they offered an image of the world cycling around its stationary state in absence of shocks, also ruled out the possibility that an economy may face the risk of global breakdown. It is perhaps no accident that Klein (1956) himself, after working with Goldberger, temporarily endorsed that approach and strove to estimate a non linear business cycle model derived from Kaldor's 1940 famous *Economic Journal* article (Assous and Raybaut 2024).

Maurice Allais' works were certainly the only exception. In his effort to analyze the causes of economic instability, he developed different versions of a nonlinear

model of business cycles which culminated in the publication of a series of long papers (some in French, some in English). His main innovation came from an analysis of the relation between the magnitude of perturbation, global instability, and the existence of multiple limit cycles and their empirical verification (Raybaut, 2014). It also came from the outlining of situations displaying a corridor of stability (a point which did not escape to Grandmont 1989) proving that there are disturbances which can end up in the sinking of the boat, here materialized in episodes of hyperinflation due to the existence of multiple limit cycles.

### Final remarks: corridor stability after Leijonhufvud

Since the publication of Leijonhufvud's 1973 paper, the corridor stability assumption aroused only lukewarm interest. Some notable contributions are however worth mentioning. Tobin (1975) is perhaps the most significant one. Like Leijonhufvud, Tobin saw in that hypothesis a possibility to transform the debate between classical and Keynesian economists. The particular nature of corridor-effects that Tobin has argued exist in the economic system was pictured in terms of what he called price level and price change effects, the two broad forces acting on the stability of the economy. The price-level effect (Pigou effect and Keynes effect, ect) would tend to make real output rise back to its full-employment value. On the other hand, the price-change effect (Fisher's effects, etc) would tend to amplify the departure of the economy from its stationary state. Depending on the size of the shocks, Tobin could hence show that the relative importance of both effects was likely to change: price level effect being likely to be strong for small shocks but weak for large ones. Tobin in particular pointed out that the liquidity trap, in neutralizing the Keynes effect, may well explain why price change effects

(resulting from gradual revisions of price expectations) may turn out to be dangerously destabilizing. Later on, Groth (1993) notably showed that Tobin's stability condition was formally identical to the stability condition found by Cagan (1956) in his classical analysis of the purely monetary dynamics in situations of hyperinflation. On the basis of "Familiar Macro Model" (IS-LM model with adaptive expectations), Groth could hence show that such a condition only entails local stability and was in fact, given the non-negativity of the nominal rate of interest, both a necessary and a sufficient condition for the "existence of a corridor" (Groth 1993: 302).

Howitt (1979) and more recently economists from the Biefeld school (Rosser, 2023) as well as more policy oriented macroeconomists (Eusepi 2010, Borio 2021) also attempted to find other "concrete embodiments" of Leijonhufvud's corridor hypothesis. However, these models (very much to the regret of Leijonhufvud, 2009) did not carry much weight in the face of the growing prominence of Dynamic Stochastic General Equilibrium (DSGE) models. In the end, and despite significant evolutions of mainstream macroeconomics which have occurred since the 2008 Global crisis, no "cosmology" change has occurred. More than a century after the publication of Fisher's 1933 article, the challenge still remains.

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