

Austrian Business Cycle Theory, Agent-Based-Model Illustration and Empirical Application

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i. Preamble

MGM Resorts International (formerly named “MGM Mirage”; hereinafter - MGM) is a major US-based international gaming, hospitality, and entertainment company. Its main business has consisted of operating large casino resorts in the US and a few other locations around the world. Its net revenue in 2007 was \$7.7 bln¹ and fell to \$7.21 bln in 2008² and \$5.98 bln in 2009³ because of the Great Recession.

In November 2004, MGM announced⁴, and in 2006 launched the construction works under, the at least hitherto most expensive private construction project in US history, the construction of a new City Center casino resort and residential space in Las Vegas, Nevada. CityCenter was supposed to open its first phase in 2009 (MGM Mirage 2005, 29).⁵ The earliest official estimate for the construction cost of the project at \$5 bln was provided in the earnings report for the second quarter of 2005 (Benston 2009). The project quickly came to be plagued by cost overruns, however. Already, the 2005 MGM annual report published in March 2006 put the overall figure at \$7 bln. In the second quarterly report for 2007, this rose to \$7.4 bln and to \$8.7 bln in the 2007 annual report published in March 2008. At the peak in August 2008, the project’s construction outlay was expected to equal \$9.3 bln but eventually, parts of it were scaled down, and it ended up sucking in around \$8.5 bln (Benston 2009).

These dramatic cost overruns seem to have been closely connected to the financial aspect of both the CityCenter project and MGM’s business as a whole. Initially, MGM was planning to complete CityCenter unilaterally but in November 2007, it convinced Dubai World to enter into a 50/50 joint venture with it to contribute to the financing of the project.⁶ In early 2009, citing the cost overruns even compared to what was projected at the moment of its entering into the joint venture, Dubai World almost quit the project.

¹ MGM Mirage 2008, p. 18.

² MGM Mirage 2009, p. 2.

³ MGM Mirage 2010, p. 2.

⁴ MGM Mirage 2005, p. 29.

⁵ MGM Mirage 2005, p. 29.

⁶ MGM Mirage 2008, p. 17.

The main sources of borrowed funds for MGM at the time were a senior revolving credit facility in the amount of \$7 bln and publicly held senior and subordinated notes. The total amount that MGM could borrow under the facility was \$7 bln, to be repaid in full in 2011. Of that \$7 bln, \$2.5 bln was borrowed as a term loan, and \$4.5 bln was in revolving loans. In its annual report for 2007, MGM estimated that it would need to repay \$1.06 bln of debt in 2008, \$1.95 bln in 2009, \$1.72 bln in 2010 and \$4.24 bln in 2011. Given how large these amounts were, compared even to the whole annual revenues of MGM in the period, this shows how much influence projects like CityCenter may exert on companies undertaking them even over a relatively short term. Another important thing to note about MGM's sources of funding is that they do not appear to have involved loans directly aimed at financing construction and secured by real estate.

Also, MGM went into non-compliance with its financial covenants under its senior credit facility in 2009, which forced it to seek a waiver.⁷ What is especially interesting is that in part in order to be able to complete the construction of CityCenter, MGM undertook certain cost reduction measures the most significant of which was reducing its staffing levels by 7% over 2008 (MGM Mirage 2009, 7).

To top it all, MGM's share price suffered a dramatic decline directly related to CityCenter woes. It fell from \$99.75 on Oct. 9, 2007, to just \$1.89 on March 5, 2009 (Yahoo! Finance). On the latter day, it was announced that the negotiations failed between MGM and Deutsche Bank with regard to a loan that would help complete the project. Eventually, the somewhat scaled-down construction was finished.

What could explain such spectacular cost overruns when the expected CityCenter price tag rose almost twofold over just three years between August 2005 and August 2008 and along with other factors almost brought the unprecedented development to bankruptcy? One explanation may be that the project was poorly designed. Indeed, this is what the share- and bondholders of MGM that sued the company in 2009 and 2012 over the losses incurred due to CityCenter claimed. There are some indications of design errors (one of the planned hotels was never finished, for instance) but the fact that the project attracted the biggest names in the industry like Cesar Pelli and Associates for the architectural part and Tutor Perini for construction makes them unlikely to

⁷ MGM Mirage 2009, p. 4.

account for the scale of the trouble. The claims of those who sued MGM also cannot be taken at face value because proving the design errors was essential if they could hope to prove the guilt of MGM's top management in the case.

It should also be noted that the project ultimately survived for one key reason. A large part of the unexpected cost increase (from \$5 bln to \$7 bln) had taken place even before the construction was started. This probably allowed MGM to restructure the project and involve Dubai World whose involvement was likely motivated by this initial increase. And even then, the development only narrowly avoided a sorry fate.

Finally, already mentioned above was the scale of the burden the CityCenter project placed on MGM. This may lead one to wonder what the consequences may be if not just one investment project-conducting firm but a multitude of them face similar financial difficulty at roughly the same time. The rest of this volume will consider whether clusters of potentially mistakenly-undertaken projects like CityCenter may be at least partly at fault for economic crises and how they may actually arise.

ii. Thesis summary

The work contained in this volume is organized as follows:

- 1) The introduction discusses the state of the business cycle theories in modern economics, considers the major parts of the predominant neoclassical approach and attempts to juxtapose ABCT to them and justify why a non-neoclassical alternative is desirable.
- 2) Chapter 1 deals with the historical background and the preceding versions of ABCT and demonstrates that they do not succeed in capturing the intuitions behind the theory.
- 3) In chapter 2, a restatement of ABCT in more realistic and disaggregated terms is attempted.
- 4) Chapter 3 presents a simple agent-based computer model illustration of the restated theory.
- 5) Chapter 4 discusses how the restated theory can be applied to the complex evidence from particular historical episodes.
- 6) In chapter 5, the theory is applied to the period preceding the U.S. Great Recession of 2007-09, and the early stages of it.

The introduction starts with a brief classification of the possible theories of the business cycle and then proceeds to analyze the major types of business cycle theories popular among the modern neoclassical economists. It is claimed that those do not adequately address the problem of the business cycle for various reasons and that the failure of the neoclassical economists to achieve consensus on the core issues involved raises the possibility that a wholly different approach may be needed, an attempt at which is made in this work.

The analysis of the previous versions of ABCT in chapter 1 shows that, although they contain potentially useful intuitions about the business cycle pattern, they are inadequate for accounting for the phenomena they are supposed to throw light upon. This concerns both the accounts based on the construct of the aggregate production structure (APS) and those that are not relying on it.

Most of the previous versions of ABCT are based on the idea of the APS, implying that all the activities in an economy in a given period can be represented as a flow of intermediate goods along several stages each of which is thought to be in some sense temporarily closer to the production of final consumer goods. The business cycle consists in either an increase in the number of stages of production or reallocation of productive activities to the earlier stages or both, which lengthens, or increases the roundaboutness, of the economy's APS. Since this happens contrary to consumers' preferences, they pressure producers into bringing the APS back into a less roundabout state, which results in the bust phase.

Among the multiple problems with this construction are the fact that it cannot account for investment projects aimed at the creation of durable capital, the incoherence of the notion of roundaboutness, given that investment projects do not result in permanently longer processes of producing the relevant consumer goods, the fact that some intermediate goods produced at supposedly later stages are used in the production at earlier ones, the incompatibility of the framework of analysis that implies convergence towards general equilibrium with genuine errors committed by the agents involved, the impossibility to distinguish the intermediate goods redistributed between stages from those that are produced at various stages, and the use of other questionable aggregative constructs like the natural interest rate and gross market interest rate.

At the same time, the three ABCT accounts that are considered here that do not appear to rely on the APS construct do not appear to be adequate in the explanatory sense. The reason for this is either that they rely on the equilibrium construct that makes it impossible for the projects erroneously undertaken as a result of credit expansion to be undertaken without being immediately undermined by the rising input prices or that they overlook the crucial problem of input scarcity altogether.

Chapter 2 devoted to reformulating ABCT starts with the intuition that ABCT is about a temporary diversion of certain resources away from the production of certain consumer goods that consumers expect to be available at a certain point during the boom period. It reformulates it such that at the heart of the business cycle is a cluster of projects that because of the credit expansion reallocates a part of certain resources (contested goods) from processes that at the start of the cycle are already contributing or are closer to contributing to the delivery of final consumer goods in the absolute sense (closer-to-consumption projects) to projects that are further away from it

(excessively long projects). The latter projects are undertaken based on genuine errors of their originators that arise to the extent that with the credit expansion they are able to borrow at interest rates at which they could not borrow before. Credit expansion does not have to be channeled entirely to such projects but their longer duration that reduces the need for banks to renegotiate loans favors them to some extent over the shorter projects available for financing at the moment of credit expansion.

The key advantage of the restated theory is that by dispensing with general equilibrium constructs it allows explaining how excessively long projects, while ultimately resulting in added competition for the contested goods, initially do not receive signals showing them that their seemingly increased viability is illusory. This happens because the prices of the contested goods do not immediately reveal the increased competition for them. The potential scenarios of how this pattern may come about are discussed. The way that the cluster of excessively long projects is revealed to be unsustainable is through consumers at some point being unable to buy the relevant consumer goods to the point that they become prepared to propose higher prices for them. This, in turn, allows the originators of the closer-to-consumption projects to propose the suppliers of the contested goods higher prices for the latter. To the extent that such price increases make costs exceed the margins of error in the calculations behind the excessively long projects, the latter either need to be abandoned or scaled down, or their originators need to slash spending on other activities. Other potential, more indirect, economically detrimental effects and interactions related to the clusters of excessively long projects are also considered.

Since the theory as it is formulated breaks with equilibrium constructs, it does not seem to be formalizable with the help of the existing mathematical modeling. However, instead, the agent-based modeling software Anylogic is used to illustrate the theory with the help of a simple model involving one excessively long project, one closer-to-consumption project, consumers, two consumer goods and one contested good. Two scenarios are presented, one in which the genuine mistake involved in the excessively long project is discovered early, and the other, where it is not, and where it is undertaken to the point in which consumers pressure the contested good price into exceeding the project's margin of error. The mechanism allowing the error to be unnoticed that is chosen involves innovation that temporarily reduces the cost of producing the contested good coupled with the initially lower use of the contested good by the excessively long project. When

its use intensifies, the effect of innovation cannot compensate for the increased competition for the contested good, anymore. Innovation is chosen over simpler potential mechanisms in part to showcase the potential of agent-based modeling for illustrating realistic economic theories like ABCT in the context of the complex and dynamic, interconnected modern economies.

The application of ABCT to such a reality discussed in chapter 4 is certainly not straightforward, and requires the identification (almost necessarily in a reflective equilibrium manner, where finding one more element improves the clout of the others and *vice versa*) of certain key elements in the given historical episode, as well as careful analysis of their interactions with other processes that took place simultaneously with the candidate cluster of malinvestments. Despite the difficulties, in chapter 5, the theory is applied with relative success to the period preceding the U.S. Great Recession of 2007-09.

In contrast to the position of some economists of the Austrian school, it is concluded that the boom in 1-4 family housing that is considered by most economists to be the primary locus of the problems that led to the crisis does not qualify as a cluster of excessively long projects envisaged by ABCT. Instead, it is argued that the boom in private nonresidential construction spending that started and burst somewhat later than the boom in 1-4-family housing construction appears to fit the bill. The patterns of price evolution of major inputs into nonresidential construction are analyzed, and steel components and potentially flat glass exhibited characteristics of plausible contested goods. In parallel, a related cluster of bank loans (acquisition, development and construction loans) is found to have exhibited a boom and bust pattern over the same period as private nonresidential construction spending.

The analysis of the troubled acquisition, development and construction (ADC) loans and particular components of nonresidential construction spending makes it possible to come up with the lower- and upper-bound estimates of the size of the potential excessively long project cluster, and the averaged final estimate of its size. The resulting estimate is probably not sufficient to consider the cluster of the nonresidential construction projects as the sole or principal cause of the U.S. Great Recession. However, this does not undermine the usefulness of ABCT. First, the bulk of the excess credit created because of the loose monetary policy of the Federal Reserve prior to the Great Recession appears to have been allocated to 1-4-housing mortgage loans, instead of financing nonresidential construction. If a larger part of the excess credit is allocated to the

excessively long projects, a larger part of the resulting crisis may be explicable by ABCT. Secondly, economically detrimental interactions of the kinds discussed in chapter 5 (such as *inter alia* the worsening of the credit crunch due to bad mortgages through the failure of banks overexposed to ADC loans, and the nonresidential construction boom potentially preventing the automobile prices from falling in response to falling demand through boosting steel costs) are possible between the clusters of excessively long projects and other economic problems caused by credit expansion.

iii. Résumé de la thèse en français

La thèse sur la théorie autrichienne du cycle économique (TACE), sa reformulation, sa formalisation et son application empirique se compose des parties suivantes :

- 1) L'introduction analyse l'état des théories du cycle économique dans la science économique moderne, considère les éléments importants de l'approche néoclassique dominant et essaie de comparer la TACE à eux, ainsi que justifier que une alternative non néoclassique soit désirable.
- 2) Le chapitre 1 traite du contexte historique et des versions précédentes de la TACE et démontre qu'elles sont inadéquates pour préciser les intuitions derrière la théorie.
- 3) Au chapitre 2, une tentative de reformulation de la TACE dans des termes plus réalistes et désagrégés est menée.
- 4) Le chapitre 3 présente une illustration simple d'un modèle informatique de la théorie reformulée.
- 5) Le chapitre 4 traite de la manière dont la théorie reformulée peut être appliquée aux preuves empiriques complexes tirées d'épisodes historiques particuliers.
- 6) Dans le chapitre 5, la théorie est appliquée à la période qui a précédé la Grande Récession de 2007-2009 aux États-Unis et aux premiers stades de développement de la crise.

L'analyse des versions précédentes de la TACE a montré que, même si elles contiennent des intuitions potentiellement utiles sur le comportement habituel du cycle économique, elles sont insuffisantes pour rendre compte des phénomènes qu'elles sont censées étudier. En particulier, toutes ces versions analysées dans la thèse, à l'exception de celle de Gimenez-Roche, sont basées sur l'idée d'une structure de production agrégée (SPA) impliquant que toutes les activités économiques dans une période donnée peuvent être représentées comme un flux de biens intermédiaires qui traversent plusieurs étapes, dont chacune est en quelque sorte temporairement plus proche de la production de biens de consommation finale. Le cycle économique consiste en une augmentation du nombre d'étapes de production et en la réallocation des activités productives aux étapes précédentes, ce qui allonge ou augmente le détour de production, de la SPA de l'économie. Étant donné que cela va à l'encontre des préférences des consommateurs, elles forcent

les producteurs à ramener la SPA à un état moins détourné, ce qui résulte dans une phase de récession.

Parmi les multiples problèmes qui résultent de cette construction, on peut notamment évoquer le fait que la TACE ne parvient pas à expliquer les projets d'investissement visant à créer un capital durable, l'incohérence de la notion de détour de production – car les projets d'investissement n'aboutissent pas à des processus durablement plus longs de production des biens de consommation adéquats, – le fait que certains biens intermédiaires produits à des stades supposés ultérieurs sont utilisés dans la production à des stades plus précoces, l'incompatibilité du cadre d'analyse qui implique une convergence vers un équilibre général avec de véritables erreurs commises par les agents impliqués, l'impossibilité de distinguer les biens intermédiaires redistribués entre les étapes de ceux qui sont produits à des étapes variées, et l'utilisation d'autres concepts agrégés discutables comme le taux d'intérêt naturel et le taux d'intérêt brut de marché.

En même temps, les trois comptes-rendus de la TACE qui sont considérés ici, et qui n'apparaissent pas reposer sur le concept de SPA, ne semblent pas adéquats dans un but explicatif. La raison pour cela est soit qu'ils reposent sur des concepts d'équilibre qui rendent impossible pour les projets entrepris de manière erronée en raison de l'expansion du crédit d'être entrepris sans être immédiatement affaiblis par l'accroissement du prix des facteurs, soit qu'ils négligent totalement le problème crucial de la rareté des facteurs.

Le chapitre théorique commence par l'intuition selon laquelle la TACE concerne le détournement temporaire de certaines ressources de la production de certains biens de consommation que les consommateurs espèrent disponibles à un certain moment au cours de la phase d'expansion. Ce chapitre reformule cela de telle sorte qu'au cœur du cycle économique, il se trouve tout un ensemble de projets qui, en raison de l'expansion du crédit, réallouent une partie de certaines ressources (biens contestés) à partir de processus qui, au début du cycle, sont déjà livrés ou sont plus proches de la livraison des biens de consommation finale au sens absolu (projets proches de la consommation) aux projets qui en sont plus éloignés (projets excessivement longs). Ces derniers projets sont entrepris sur la base de véritables erreurs commises par leurs auteurs qui se produisent dans la mesure où, avec l'expansion du crédit, ils peuvent emprunter à des taux d'intérêt plus faibles qu'auparavant. L'expansion du crédit ne doit pas nécessairement être entièrement acheminée auprès de tels projets, mais leur durée plus longue, réduisant la nécessité

pour les banques de renégocier leurs prêts, les favorise dans une certaine mesure sur des projets plus courts et ouverts au financement au moment de l'expansion du crédit.

L'avantage clef de la théorie reformulée est qu'en se débarrassant du concept d'équilibre général, elle permet d'expliquer comment les projets excessivement longs, tout en résultant finalement en une concurrence accrue pour les biens contestés, ne reçoivent pas initialement les signaux qui leur montrent que leur viabilité apparemment accrue est illusoire. Cela se produit car les prix des biens contestés ne révèlent pas immédiatement la concurrence accrue pour leur acquisition. Les scénarios potentiels quant aux alternatives que ce schéma peut engendrer sont ainsi discutés. La manière dont l'ensemble de projets excessivement longs se révèle insoutenable est que les consommateurs ne sont parfois pas en mesure d'acheter les biens de consommation adéquats au point qu'ils deviennent disposés à proposer des prix élevés pour ces biens. Cela permet aux auteurs de projets proches de la consommation de proposer à leur tour aux fournisseurs de biens contestés des prix plus élevés pour ces biens. Dans la mesure où ces prix dépassent la marge d'erreur dans les calculs réalisés pour les projets excessivement longs, ceux-ci doivent être abandonnés ou réduits, ou leurs auteurs doivent réduire la dépense dans d'autres activités. D'autres interactions et effets potentiels, plus indirects et économiquement préjudiciables, liés aux ensembles de projets excessivement longs sont aussi considérés.

Puisque la théorie telle qu'elle est formulée s'affranchit du concept d'équilibre, elle ne semble pas formalisable à l'aide de la modélisation mathématique existante. Cependant, le logiciel de modélisation basé sur l'agent Anylogic est utilisé pour illustrer la théorie à l'aide d'un modèle simple impliquant un projet excessivement long, un projet proche de la consommation, des consommateurs, deux biens de consommation et un bien contesté. Deux scénarios sont présentés : un dans lequel l'erreur majeure impliquée dans le projet excessivement long est découverte au début ; et l'autre, où elle ne l'est pas, et où elle est maintenue au point que les consommateurs font pression sur le prix du bien contesté en dépassant la marge d'erreur du projet. Le mécanisme permettant à l'erreur de passer inaperçue qui est choisi implique une innovation qui réduit temporairement le coût de production du bien contesté associée à une utilisation initialement plus faible du bien contesté par le projet excessivement long. Lorsque son utilisation s'intensifie, l'effet de l'innovation ne peut plus compenser la concurrence accrue pour le bien contesté. L'innovation est choisie sur des mécanismes potentiels plus simples en partie pour mettre en évidence le

potentiel de la modélisation basée sur l'agent afin d'illustrer des théories économiques réalistes comme la TACE dans le contexte des économies modernes, complexes, dynamiques et interconnectées.

L'application de la TACE à une telle réalité n'est certainement pas simple, et requiert l'identification (à la manière presque nécessaire d'une théorie réfléchie de l'équilibre, où l'obtention d'un élément de plus améliore l'influence des autres et *vice versa*) de certains éléments clefs dans l'épisode historique donné, ainsi qu'une analyse minutieuse de leurs interactions avec d'autres processus qui se sont produits simultanément avec l'ensemble de malinvestissements. Malgré les difficultés, dans le chapitre empirique, la théorie est appliquée avec un succès relatif à la période précédant la Grande Récession de 2007-2009 aux États-Unis.

Contrairement à la position de certains économistes de l'école autrichienne, il est défendu que l'expansion du logement à caractère familial, qui est considéré par la plupart des économistes comme le nœud principal des problèmes qui ont conduit à la crise, ne peut être qualifié comme l'ensemble de projets excessivement longs envisagé par la TACE. Au lieu de cela, nous trouvons que l'expansion des dépenses privées de construction non-résidentielle qui a commencé et éclaté quelque peu après l'expansion dans la construction de logement familial semble être une bonne explication. Les caractéristiques de l'évolution des prix des principaux facteurs dans la construction non-résidentielle sont analysées, et les composants en acier et potentiellement le verre plat ont présenté des caractéristiques de biens contestés. En parallèle, un groupe apparenté de prêts bancaires (emprunts d'acquisition, de développement et de construction) a montré une tendance à l'expansion et à la récession sur la même période que les dépenses privées de construction non-résidentielle.

L'analyse des prêts non courants et des composants particuliers dans la dépense de construction non-résidentielle permet de proposer des estimations plus faibles et plus élevées de la taille du groupe potentiel de projets excessivement longs, et l'estimation finale moyenne de sa taille. L'estimation qui en résulte est probablement non suffisante pour considérer l'ensemble des projets de construction non-résidentielle comme la seule cause de la Grande Récession aux États-Unis. Cependant, cela ne remet pas en cause l'utilité de la TACE. Tout d'abord, la majeure partie de l'excès de crédit créé du fait de la politique monétaire accommodante de la Fed avant la Grande Récession semble avoir été alloué aux prêts immobiliers hypothécaires au lieu de financer la

construction non-résidentielle. Si une plus grande partie de l'excès de crédit est allouée à des projets excessivement longs, une plus grande partie de la crise qui en résulte peut être expliquée par la TACE. D'autre part, les interactions négatives sur le plan économique décrites dans le chapitre empirique (par exemple, l'aggravation de la crise du crédit en raison de mauvaises hypothèques à cause de l'échec des banques surexposées aux prêts ADC, et l'expansion de la construction non-résidentielle empêchant potentiellement les prix de l'automobile de tomber en réponse à la baisse de la demande grâce à l'augmentation des coûts de l'acier) sont possibles entre les groupes de projets excessivement longs et d'autres problèmes économiques causés par l'expansion du crédit.

Introduction

1. Why the business cycle still matters

Compared to the economic fluctuations many economies of the world experienced in the first half of the last century and before, the importance of economic volatility has certainly decreased in the recent decades. For instance, even the latest crisis that is often referred to as the Great Recession decreased the U.S. real GDP by only 4.3% from its peak in the fourth quarter of 2007 to the trough in the second quarter of 2009 (Reich 2013).

However, there are at least two perspectives from which economic fluctuations remain highly dangerous if the secondary effects of the potential initial downturn are taken into effect. Both of those perspectives are informed largely by the experience of the Great Depression where an initially mild recession escalated into a catastrophic crisis that lasted for several years and may well have been instrumental in bringing the Nazis to power in Germany in 1933, which led to the subsequent bloodshed of WW2.

The first of the aforementioned perspectives is the broadly Keynesian view that will be discussed in somewhat more detail below that implies that even relatively small initial declines in the aggregate demand, whatever their trigger, may result in a runaway feedback loop in which the situation is continually deteriorating because people postpone all but the most basic purchases in anticipation of further price declines, which reduces the incomes of producers, forces firms to cut wages, lay off workers or reduce working hours. The nominal income reduction further depresses aggregate demand and feeds back into the downturn.

It would be beyond the scope of this work to consider the aggregate demand approach to recessions at length but it has to be noted that even if it is judged implausible, there are serious reasons to fear recessions if one considers it plausible that the government's political response to a recession may badly exacerbate the initial downturn. With regard to the Great Depression, the monetarist version of this viewpoint (*e.g.* Friedman & Schwartz, 1963, Eichengreen, 1996) is that the U.S. Federal Reserve, in particular, failed to offset the rapidly rising demand for money balances by increasing the money supply. In the presence of rigid wages, this led to businesses

having no other choice but lay off employees. As discussed below, there are even some monetarists who take a similar stance with regard to the latest recession.

Another line of reasoning, while not necessarily rejecting the monetarist argument, emphasizes government non-monetary responses such as the Smoot-Hawley tariff and the policy started early on by President Hoover (and boosted by his successor's attempt at forced cartelization of the whole economy via the NIRA) of attempting to cajole business into not lowering nominal wages in exchange for the promise to rein in labor unions of which businesses were fearful (Ohanian 2009). The former measure resulted in a cycle of retaliation, reduced the international trade, and thus exports and imports, delivering a tough blow to the already weakened economies. The high-wage policy arguably created or strengthened the rigid-wage effect that possibly translated the increased demand for money balances emphasized by the monetarists into catastrophic unemployment. As discussed below, while there is no consensus among macroeconomists on the effects of the high-wage policy during the Great Depression, the evidence implicating it appears rather persuasive.

In addition to the real-world significance of understanding business cycles with a view to avoid crises or at least mitigate or not exacerbate them, the problem of business cycles is a fascinating scientific issue in its own right. To start with, this is the issue that separates those economists who believe that macroeconomic phenomena, while large-scale, can be explained solely with reference to a myriad of individual decisions of consumers, producers, policy-makers and other agents, and those who believe that, in the words of Paul Krugman (n.d.), "there is something about macro." The adherents of the latter view may actually argue that, as discussed below, major existing treatments of the business cycle, regardless of their ultimate explanatory conclusions, use essentially aggregate constructs like representative consumers, despite their rhetoric about the importance of microfoundations.

The second major reason why the business cycle phenomenon is highly scientifically interesting, that is somewhat related to the first, is that it is linked to the larger issue of the extent to which the complex emergent dynamic order (that the modern market economy is) is coordinative and robust without major external interference. At least today, such interference mostly arises from a social order based at least at a first approximation on very different principles than those of the market economy, i.e. government. The ultimate question is whether the market

economy, if left to its own devices, will produce systemic instability, or whether such instability may only arise from the outside.

This work attempts to revive one of the oldest theories of the business cycle developed by the economists of the Austrian School (Austrian Business Cycle Theory, or ABCT). Before we wholly devote our attention to it, however, we must look at the types of business cycle theories and the options provided by the predominant neoclassical approach to macroeconomics to see why something different might be necessary to move forward.

2. Types of business cycle theories

Over the history of economic fluctuations, many explanations have been proposed as to why this phenomenon takes place. It is not the objective of this work to delve deep into the history of economic thought on this matter but a relatively brief classification is in order.

First of all, the word “cycle” may imply that there is some kind of fixed pattern of recurrence of the business cycle phenomenon. This approach to the business cycle was born with Marx’s approach to economics,⁸ in which the capitalistic system, due to its unjustified appropriation of part of the workers’ income through profits that accrue to the capital owners, was bound to produce more than the population that consists mostly of workers can consume. Economists like Kondratieff⁹ and Kuznets (1930) attempted to show that there indeed was a periodicity in the economic volatility, although their arguments for why it was the case were not necessarily Marxist. With the development of more rigorous econometrics, the evidence for such periodicity has been shown to be inadequate by among others Howrey (1968), and Solomou (1986, 1987). Hence, the consensus of the modern macroeconomists, regardless of their approach to accounting for the business cycle phenomenon, is that it is of a non-periodic nature.¹⁰

⁸ See, for instance, Marx 2000 (1863), chapter XVII.

⁹ See, for instance, Kondratieff 1984 (1925).

¹⁰ From the Austrian School’s perspective to which this author adheres, the neoclassical economists are correct here. Since economic phenomena ultimately arise from individual choices made in the somewhat unique circumstances of time and place, there can be no such thing as a boom and bust cycle mechanically repeating with a certain regularity.

Secondly, another major classification of business cycle theories is about whether they attempt to mostly explain the initial phase of the crisis and the prelude to it (the boom), the secondary downturn or both. The major neoclassical business cycle theories will be briefly considered one by one below but those that belong to the first group include the real business cycle theory and the theory developed in this volume, namely Austrian Business Cycle Theory (hereinafter, ABCT). Keynesian and monetarist accounts of economic fluctuations may be said to mostly preoccupy themselves with the secondary effects of the starting downturn, implicitly considering the initial triggering factor to be relatively unimportant. Certain explanations of particular business cycle episodes may attempt to consider in-depth both the boom-and-bust phase and the secondary crisis phase. For instance, the explanation of the latest crisis proposed by Friedman and Kraus (2011) or the account of the Great Depression by Olney (1999). The former claims that the Great Recession was caused by the subsidization and other types of encouragement of housing construction by the U.S. government. Olney finds the source of much of the Great Depression's economic downturn in the debt overhang of consumers with durable good loans. Neither of the accounts explicitly or implicitly separates the initial and secondary phases. However, the question may be asked whether such theories should actually be considered as business cycle theories since they are potentially specific to some historical boom and bust episodes. However, as demonstrated below, even ABCT probably cannot account for every historical boom and bust event, hence, in what follows the term "business cycle theory" will not be used in the universalist sense of striving to explain all of what has historically been termed "business cycle" but rather in the sense of potentially being applicable to a variety of actual boom and bust episodes. Certainly, both the subsidy-focused and durable-consumer-loan-debt-based explanations are potentially applicable to many real-world examples.

Another essential basis for classification is whether a given account of the business cycle considers it to be exogenously or endogenously produced, or, in other words, whether major fluctuations are caused by external factors like the government's monetary policy or productivity shocks or internal dynamics like asset-market bubbles. The necessary caveat, however, is that perhaps almost none of the theories proposes a purely internal or external mechanism of causation, as it will become clear when major theories are briefly discussed below. But what matters is the crucial causal element that is only at times present to a sufficiently significant extent.

Among endogenous-mechanism theories one finds various variants of Keynesianism, the debt-deflation theory of Fischer (1933)¹¹ and its modern versions (*e.g.* Gjerstad & Smith, 2013), the asset-bubble theories (*e.g.* Geanakoplos, 2009), behavioral theories (*e.g.* Jaimovich & Rebelo, 2007) endogenous credit crunch accounts (Bernanke, 1983, Cochrane, 2014), etc. Theories of the latter type are somewhat difficult to classify as strictly endogenous-mechanism-based ones because of the emphasis they may make on the failure of the central bank to act to recapitalize, relieve or replace troubled banks or other financial institutions as a source of lending to the economy. Prominent exogenous-mechanism accounts include monetarist ones, the real business cycle theory, the monetary illusion theory of R. Lucas (1977) and ABCT.

A classification criterion that is relatively closely related to the endogeneity-exogeneity distinction is whether the business cycle theory in question presupposes the presence of inherent coordination problems in markets or not. Most of the endogenous-mechanism accounts are market-failure theories and *vice versa*. However, there are exceptions to the rule. For instance, some monetarist explanations that are essentially exogenous may cite inherent price or wage stickiness (not arising, for instance, from government regulations like minimum wage laws and trade unions' rights to influence wages) as a necessary condition for bad monetary policy to translate into a crisis. Conversely, it is possible to imagine a spontaneous asset-bubble theory of crises that would refrain from implying that a certain internal feature of markets is a problem that could somehow be addressed, except for not exacerbating the issue through artificially providing market participants with additional liquidity (Deck, Porter and Smith 2011).

3. A Brief survey of the major neoclassical business cycle theories

Over the years since the business cycle became a major question of interest, especially after the economic catastrophe of the Great Depression, the sheer volume of academic literature on the topic has become so vast that one cannot pretend to be able to do it any justice in a brief literature outline. The objective here will be to merely consider the most popular current academic

¹¹ A question may be asked whether Fischer's debt-deflation theory is merely one of the variants of Keynesianism. However, the fact that it does not involve the interaction between aggregate demand and price expectations as the central element, it is best considered distinct.

approaches: (New) Keynesianism, Real Business Cycle theory, and monetarism. But even as was briefly mentioned above, there are many other approaches to studying economic fluctuations that do not fit into either of the three major frameworks discussed.

Besides, it has to be noted that even those frameworks are not strictly distinct. As will be discussed in the case of monetarism, for instance, it has incorporated to some extent the New Keynesian ideas like sticky prices. In some cases, the difference between Keynesian and monetarist models seems to come down to the question whether monetary policy is sufficient to prevent economies from sliding into major recessions or prolonged stagnation or whether fiscal stimulus is needed at least in certain cases. It may even be argued that the Keynesian-monetarist distinction does not even hold water anymore but addressing this issue is beyond the scope of this work. Nonetheless, the grouping in question can be considered as a potentially useful way of organizing a major part of the literature but not something that allows deducing a lot about a particular academic paper merely from its assignment to one of the categories.

3.1 Keynesianism

Interpreted very broadly, Keynesianism is a family of economic theories that, as was mentioned above, consider markets to lack a stable mechanism for decentralized coordination to counteract an economic downturn that is characterized by a temporary decrease in the aggregate demand. Alternatively stated, Keynesians believe that the things that are normally beneficial during the times of economic growth or stability (for example, firms lowering wages in response to revenue declines) become “vices” during economic crises.

Keynesianism originated in Keynes’ (1936) seminal book but, despite its arguably transformative impact on economics and economic policy, it has remained difficult to interpret, and to this day there is arguably no consensus about what Keynes really meant. For instance, Leijonhufvud (*e.g.* 1980, 1998) claimed with some justification that neither the old Keynesian approach nor the New Keynesian replacement, both of which are briefly discussed below, exactly do justice to Keynes’ macroeconomic ideas.

The first influential academic interpretation of Keynes's work was proposed by Hicks (1937) and Hansen (1953) in the form of the famous IS-LM model. That model became the basis for more complex aggregate-based econometric models of the whole economy (Mankiw and Reis 2017). However, IS-LM and its econometric complements suffered from being based purely on aggregates without explicitly treating the actual choosing agents. The combination of the economic stagflation of the 1970s¹² and the critique launched by Lucas (1976) and followers who invoked the need for microfoundations temporarily relegated Keynesianism to the economics' backwater.

The revival of Keynesianism's fortunes can be dated to the late 1990s when economists started noticing (Krugman, 1998) the puzzling economic predicament that hit Japan during the "lost decade" after the preceding investment boom. The problem was that, despite the fact that the Japanese central bank had been engaging in expansionary monetary policy for several years, the interest rates on government bonds remained close to zero and the economy was in a recession. In addition to this, Mankiw (1985) and others showed how certain Keynesian ideas, like sticky prices, can be incorporated into Lucas-critique-compatible intertemporal models.

Krugman's solution to the Japanese "lost decade" problem was to reformulate Keynesianism in terms of the "liquidity trap." While Krugman believed that the IS-LM model was still a good economic heuristic, he purported to show that it was possible to use a rational-expectation-based model to produce a liquidity trap. Eggertson and Woodford (2003, 2004) made a more complex model to develop Krugman's logic further and to address the weak points of his simple model.

The idea of the liquidity trap places very strong emphasis on the interplay between monetary dynamics and the demand for the so-called "safe assets," the most important example of which is government bonds. The basic logic of the theory is that in a liquidity trap situation, for some reason, people believe that the central bank will fail to sustain as much inflation in the future as its current actions purport to imply. In Krugman's (1998) initial simple model, this results from the starting assumption that starting from the second period of the model, the money supply and

¹²In the old Keynesian framework, stagflation, which is a combination of unemployment and inflation was considered impossible because according to the Philips Curve, the relationship between unemployment and inflation was inverse.

output are fixed. Since the price level in this model is just the ratio of money supply to output, it is also bound to remain fixed from the second period onwards.

The model used by Eggertson and Woodford (2003, 2004) is more complex as, instead of considering the future inflation fixed, it makes the inflation rate in the current period a function of the output gap. In its turn, the output gap depends on how much the current real interest rate (nominal interest rate minus the expected rate of inflation) deviates from the natural interest rate. If the rate of expected inflation is significantly negative and the natural interest rate is relatively low, the nominal interest rate has to be negative to avoid a positive output gap, but, normally, nominal interest rates cannot be negative.

In Krugman's model, it is obvious how monetary policy becomes impotent because the current increase in money supply by definition cannot be sustained in the future. Eggertson and Woodford's treatment is somewhat more flexible as it suggests that the only way a central bank can correct the output gap is to change the expected future price level change, which may not be an easy thing to do but is at least possible.

It is certainly not the purpose of this work to engage in detailed criticism of Keynesianism,¹³ as well as any other major class of business cycle theories, however, it has to be noted that the most implausible element of it, at least in its current form, is the idea that consumers will make their decisions at least with regard to relatively expensive purchases according to their inflation expectations. Even if people notice that some deflation has occurred, it is unclear why they would expect prices in general to fall further. Of course, this does not matter for the coherence of the liquidity trap supporting models because within them this is just an assumption, but this does not prevent us from asking the question to what extent those models apply to the real world. There has been some progress in the recent research in this regard in that some economists (*e.g.* Coibion & Gorodnichenko, 2015; Malmendier & Nagel, 2016) finally set out to study empirically how consumers and firms actually form expectations about price changes. However, these studies do not seem to provide strong evidence that those expectations actually figure importantly in the decisions like whether to buy a washing machine now or later or buy a cheaper one instead of a

¹³ For a prominent new classical critique of the New Keynesian liquidity trap approach, see Cochrane (2013). His key point is that the counterintuitive effects of the zero lower bound on nominal interest rates in the relevant models arise from the choice of particular equilibria, where multiple options are possible.

more expensive one and so on, which are probably actually driving the observed decreases in the aggregate demand. To provide an analogy from pre-election opinion polling, one may ask voters what they think about the success of, for instance, the incumbent's foreign policy with regard to the conflicts in the Middle East. This does not, however, mean that these responses actually affect how the respondents will vote.

The second major weakness of the liquidity trap perspective is that it only considers government bonds as the potential means of attracting the money hoarded by consumers for investment. In reality, even during a crisis, there are still alternatives like bank deposits and other securities. The implications for Krugman's model are obvious from the first issue, and the approach proposed by Eggertson and Woodford suffers from a combination of both. First, it appears unjustified to use government bond or interbank interest rates as a proxy for the actual nominal rates in the economy. There is no empirical evidence of banks actually granting loans at rates equal to those. Secondly, there may well be no real-world counterpart to the expected future inflation rate in the model, unless one implausibly assumes that the central bank has somehow been consistently deliberately reducing the money supply.

An alternative, more plausible, interpretation of the decreases in aggregate demand is that all consumers do not lower their demand for everything but rather that some consumers reduce their demand for certain types of goods and services because they become too expensive for them at the current prices. They, thus, hoard money because they have some ideas on what they are hoping to spend it in the future instead. While for Keynesians the reason why these people are not prepared to buy certain goods at their current prices is essentially irrelevant for assessing the crisis because the aggregate demand is aggregate demand, a more disaggregated perspective may attribute a higher significance to this question. ABCT, that is considered and reformulated in this work, is an example of such a perspective, however, as it will be elaborated upon further below, this work mostly omits the consideration of the crisis dynamics beyond the initial phase. It may briefly be noted, nonetheless, that the neglected investment options beyond government bonds may provide the very market-based mechanism for the economy to start recovering, even when price and wage rigidities complicate the picture. For instance, entrepreneurs may propose to banks investment projects with high anticipated future profitability. Such entrepreneurs may be prepared to pay higher interest rates on the loans than the originators of the otherwise undertaken or

proposed ones, which, in turn, may allow banks to propose to the consumers hoarding money sufficiently high deposit rates to persuade them to provide additional financial capital for investment.

An adherent of the Keynesian approach may, of course, object that without it there is no conceivable way of throwing light on the Japanese economy's recent predicament, for instance. However, the invocation of the Japanese experience in the last three decades does not appear to be as strong a piece of evidence for the liquidity trap narrative as its adherents perceive it to be. First, much of the decline or stagnation that the Japanese economy has experienced may in large part be a simple matter of the country's deteriorating demographics. According to the data from OECD, from its peak at 86.95 mln in December 1993, it fell to 76.07 mln in August 2017, a 12.5% decline.¹⁴ The population also almost ceased to grow starting from the early 1990s. One can, of course, object that most of the decline in Japan's workforce took place after 2002, yet the country's GDP did not perform worse than during the period of demographic stagnation. However, the explanation for the latter is that, while briefly stalling in the early 1990s, output per worker started to grow again in the late 1990s, which continued into the 2000s (Sanchez and Yurdagul 2014). Even in the 2007-2011 period, total factor productivity grew by 0.33% per year.

Secondly, the very expansionary monetary policy that tried to address the "lost decade" and continued unabated into the 2000s may, instead of being merely a tool for transferring money into hoarders' pockets, have resulted in keeping afloat inefficient firms that would have otherwise failed and released their employees and capital (*e.g.* Caballero, Hoshi & Kashyap, 2008) McGowan, Andrews and Millot (2017) provide evidence of the importance of such "zombie firms" for the sluggish recovery after the latest global crisis in several OECD countries.

It has to be added, though, that even if one of the variants of Keynesianism is more or less correct, it is not necessarily incompatible with ABCT, since, as previously mentioned, ABCT focuses on the boom and the initial stage of the bust, while Keynesianism largely treats those as unimportant (for instance, as sources of stochastic disturbances) and deals with the secondary

¹⁴ Organization for Economic Co-operation and Development, Working Age Population: Aged 15-64: All Persons for Japan [LFWA64TTJPM647S], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/LFWA64TTJPM647S>.

decline. That said, in terms of the fundamental assumptions about the degree of market coordination, the two approaches are considerably at odds.

3.2 Real Business Cycle (RBC) models

The roots of the RBC approach lie in the influential paper by Kydland and Prescott (1982).¹⁵ The central idea underlying this class of models is that the economic fluctuations that are observed may actually not be caused by coordination failures or bad monetary policy but, rather, may result from ‘real’ shocks. The term ‘real’ here means not arising from monetary factors, such as bad monetary policy or increased demand for money balances. Although this assumption is not strictly necessary for RBC models, most of the economists who use them appear to share the fundamental assumption that markets possess coordinative properties sufficient for reallocating resources during recessions without major declines of economic activity, unless the relevant mechanisms are impaired by government anti-crisis measures, which may themselves act as a form of real shocks.

Kydland and Prescott were initially inspired to posit real shocks as the potential explanation for the observable economic volatility (which varies among various aggregates such as durable and nondurable consumption, output as a whole and investment, and which is characterized by widespread procyclical comovement) because they managed to roughly reproduce its pattern with the help of a model that did not include monetary policy at all.¹⁶

Over the course of the development of the RBC approach, many potential exogenous shocks were proposed as explanations for recessions. Rebelo (2005) lists oil shocks, fiscal shocks, investment-specific technological change, “news shocks” and deterministic cycles. He even considers the line of research on the role of bank failures during the Great Depression and other crises initiated by Bernanke (1983) as belonging to the RBC tradition, although it is probably usually considered to be closer to monetarism.

¹⁵ For a detailed review of the history of RBC models, see, for example, Rebelo (2005).

¹⁶ Rebelo 2005, p. 4.

The key objections to RBC models according to Rebelo are the dynamics of asset prices and the depth of the economic hardship that characterized the Great Depression. The puzzle associated with asset prices is that in line with the assumed individual preferences of investors there should be no major observable difference between the returns on stocks and bonds. In practice, there is such a difference, which is called the ‘equity premium’.

The magnitude of the Great Depression is challenging for RBC models because there does not seem to be a plausible real shock, such as a technological change or a war, or a natural disaster that would be able to account for its depth. However, RBC theorists like, among others, Chistiano, Motto, and Rostagno (2004) and Cole and Ohanian (2004) responded by identifying as such shocks the U.S. government’s policies aimed at artificially maintaining wages and prices at unsustainably high levels, the Smoot-Hawley Tariff and the worst drought in U.S. history until then.

The RBC explanation that appears the most plausible is the one linking the severity of the Great Depression, first, to the high-wage policy initiated by President Hoover, and then to the expansion of this policy by his successor in the form of an attempt to impose cartelization through the National Recovery Act. Ohanian (2009) showed that Hoover cajoled major industrial companies into cooperating with the policy without direct commands by promising them to rein in trade unions whose increasing clout they were fearing. The most compelling piece of evidence Ohanian cited was the hitherto overlooked data on the supply price of labor offered by the applicants for female clerical jobs in various industries obtained by Simon (2001). They suggested that the average supply wage was lower than the actual average wage by a staggering 40%.¹⁷

Arguably, the most controversial idea within the RBC framework, that even made it subject to some derisive ridicule in the past, is that a large part if not the bulk of the observed economic fluctuations are caused by technological shocks. Rebelo (2005) argued that the way some RBC theorists measured the total factor productivity masked the endogeneity of some of the shocks they identified as purely exogenous. Rebelo still concluded that technology shocks are important. In contrast, Gali (1999, 2004) claimed that the U.S. data contradict the idea that technology shocks have the desired impact.

¹⁷ Remarkably, Simon interpreted this evidence as running counter to the idea that labor markets clear during crises if left to their own devices.

As far as the compatibility between ABCT and the RBC approach is concerned, the latter is perhaps the closest to ABCT in terms of its conclusions since it generally affirms the coordinative properties of markets and seeks to explain systemic economic woes with reference to exogenous disturbances and distortions. However, as discussed below, methodologically, at least in terms of formulating theories, the two approaches are rather distinct.

3.3 Monetarism

Monetarism is a broad family of theories and models that may be defined as based on the idea that “money matters” in the short run, even though it is neutral in the long run. While monetarists share the first postulate with some New Keynesians, it is the second one that appears to distinguish them from the latter.¹⁸ There are two major questions relative to the business cycle that have particularly interested the economists in the monetarist tradition: which monetary policy, if any, can avoid booms and busts, and if the crisis has already happened, how should central banks react?

Arguably, the father of modern monetarism, Milton Friedman,¹⁹ believed on the basis of his study of the empirical evidence from the U.S. economy that crises are not produced by expansionary monetary policies. The evidence which he relied on for the first conclusion showed that the depth of busts was uncorrelated with the height of the booms. Rather, certain transient problems (for instance, stock market panics) turn into economic downturns because central banks fail to accommodate the temporarily increased demand for money balances.

His second claim was based on his and Schwartz’s research into the history of the Great Depression. The natural takeaway from the latter was that central banks should prevent crises from escalating into depressions. At the same time, Friedman was skeptical about the capacity of monetary policy to influence long-term outcomes, as he believed that the economy would

¹⁸ It should be noted that labels like monetarism or New Keynesianism ultimately characterize theories or models, and not necessarily their authors with respect to the whole bodies of their work. In other words, it is possible for an economist to write some papers in line with the monetarist tradition and some in the New Keynesian one, for instance.

¹⁹ As summarized in Mankiw and Reis (2017).

eventually return to the natural unemployment rate. In other words, he adhered to the idea of long-run monetary neutrality.

Some recent researchers, especially of the New Keynesian bent (*e.g.* Summers, 2013) have contested Friedman's certainty about the long-run monetary neutrality, and, according to the overview of the state of the neoclassical macroeconomics by Mankiw and Reis (2017), this remains a hotly debated issue. One of the arguments the non-neutrality adherents make is that the world economy may be in a situation predicted by Keynes where there is a heightened desire for saving and a lack of investment opportunities.²⁰

Some contemporary monetarists like Taylor (2014) disagree with Friedman with respect to his conviction that monetary policies cannot trigger the initial downturn. In particular, Taylor points out that the Federal Funds rate that the Fed targeted was far below what would have been recommended by the Taylor rule between 2003 and 2005, during exactly the years when the bulk of the housing boom considered to be at the core of the subsequent crisis unfolded. Taylor claims that had it not been kept so low for so long, there would have been no dramatic housing boom and bust. He suggested that the key way in which discretionary monetary policy fueled the bubble was through allowing for very attractive rates on the adjustable-rate mortgages. Taylor's view of the crisis causation is supported by the broader empirical research into the connection between monetary policy and excess risk-taking conducted by Bekaert, Hoerova and Lo Luca (2013).

As for the monetary policy response to crises, historically, monetarists thought that central bank should stabilize the economy through attempting to influence and guide money market interest rates like the U.S. Federal funds rate, in particular through open-market purchases of government bonds. During the last crisis, central banks like the Federal Reserve engaged in some non-conventional policies such as also purchasing mortgage-backed securities (MBS) in addition to the more traditional government bonds. According to the data from the Federal Reserve Bank

²⁰ This is perhaps the most radical idea put forward by Keynes. From this author's perspective, it is highly implausible for various reasons. First, there is no solid empirical evidence showcasing the required lack of investment opportunities, and the available accounts like that by Gordon (2012) are not convincing. Secondly, even if a lack of investment opportunities were present, as was mentioned before, the idea that consumers would just continuously hoard money without some idea on what they might spend it in the future is implausible.

of St. Louis, the Fed's holdings of MBS went from zero in 2008 to \$1.7 trillion by the end of 2014, and have been stable since then.²¹

Overall, there is almost a consensus among contemporary monetary economists about two major facts about the recent decades. First, they point to the success of well-managed central banks like the European Central Bank at keeping average inflation close to their targets, even though, in some cases, they are prepared to trade stability for inflation (Mankiw and Reis 2017). Secondly, there is a widespread belief that the active intervention by major central banks in the wake of the global financial crisis of 2008 prevented the world economy from sliding into another profound crisis (*e.g.* Almunia, et al., 2010, Mankiw & Reis, 2017). The assessment of the severity of the initial shock is based on the initial severe decline in industrial production that was comparable to that at the beginning of the Great Depression. However, in contrast to the early 1930s, there was no catastrophic reduction in economic activity.

Some dissenting voices among monetarists (*e.g.* Taylor, 2014; Beckworth, 2017) have pointed out that, given the sluggish recovery of most economies from the global financial crisis that hit in 2008, with some countries remaining in recession until 2010-2011, and the recovery so far mostly not bringing most economies back to the long-term growth trend, the central banks' performance is to be judged as a mixed bag at best. They have criticized the Fed, in particular for pursuing inconsistent policies in trying to jumpstart lending through massive securities purchases with one hand while paying interest rates on the banks' excess reserves created this way,²² disincentivizing banks from increasing lending. They also point at the conundrum facing the Fed and other central banks in which they have difficulty selling their vast securities holdings while needing to prevent the whole enormous increase in the monetary base they created from being unleashed on the economy and potentially leading to runaway inflation. Some (Taylor, 2014) also suggest that the unconventional anti-crisis policies have impaired the recovery because they have been unpredictable and added to the uncertainty. Finally, some monetarists have called upon central banks to abandon price level and interest rate targeting and embrace targeting aggregate nominal spending, instead (*e.g.* Selgin, Beckworth, & Bahadir, 2015). Most monetarist critics of

²¹ Board of Governors of the Federal Reserve System (US), Mortgage-backed securities held by the Federal Reserve: All Maturities [MBST], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/MBST>.

²² See, for instance, Selgin, Beckworth & Bahadir, 2015.

central banks' recent performance seem to agree, however, that the actions of central banks that were more in line with the traditional lender-of-last-resort function were necessary and beneficial.

3.4 What the neoclassical explanations have in common and why they cannot arrive at shared conclusions

After a quick survey of the major types of neoclassical accounts of economic fluctuations, it is important to ask the question what areas of widespread agreement, if any, exist at present among the neoclassical macroeconomists whose chief business cycle paradigms we have just surveyed. It will help to locate ABCT with respect to them.

The primary area of consensus appears to be more methodological than with respect to particular conclusions. Neoclassical economists appear to believe that intertemporal and dynamic stochastic general equilibrium models are useful for understanding the real-world economic fluctuations, although they have been modifying some of the previous assumptions, attempting to introduce elements such as bounded rationality, financial frictions, and empirically-grounded expectation-formation mechanisms into the models.

However, the very fact that there is still no consensus among the neoclassical business cycle theorists either with regard to the general mechanisms behind booms and busts or the causes of particularly important episodes such as the U.S. Great Depression and the U.S. Great Recession suggests that, perhaps, there may be some methodological problems about the whole approach that those models take, even though this is not necessarily the case.

4. Why an alternative to the neoclassical explanations may be needed

The survey of the major modern neoclassical theories of the business cycle above raises the question whether a non-neoclassical explanation (like ABCT to which this work is devoted) is actually necessary or whether we just need to wait for better empirical tools to be able to adjudge which of the former is right. Indeed, one may say that explanations from a different methodological

vantage point face a very heavy burden of proof given that they are not acclaimed by a substantial part of the academic economists. This author hopes that after finishing reading this work, the skeptics will at least not consider the very idea to be absurd.

What are the fundamental methodological problems of the prevailing approach to studying major economic fluctuations that potentially make an alternative desirable? First, agents even in the most complex neoclassical models make, in essence, aggregative choices, even if those models supposedly rest on microfoundations. In the real-world recessions, for instance, probably only some consumers reduce purchases of some goods because they at least vaguely plan to purchase some other goods. In neoclassical models, the representative consumer chooses how much of the aggregate of consumer good varieties to purchase at a given price level, nominal interest rate, etc., and how much of her budget to allocate to safe assets and liquidity. This approach arguably distorts economic realities that it is supposed to throw light upon almost beyond recognition. In a similar fashion, the neoclassical perspective dispenses with genuine uncertainty in favor of assigning a probabilistic nature to the possible outcomes, thus essentially banishing the possibility of genuine error from the economic reality, with things that are most plausibly interpreted as errors considered to be results of utility-maximizing behavior instead, no matter how unconvincing such claims often look.

In a related way, the kinds of models used by neoclassical business cycle theorists also fail to incorporate - and are arguably incapable of genuinely incorporating - innovation and entrepreneurship. Innovation is, by definition, unpredictable, it consists of unique events, hence, there can be no rational or even boundedly rational way of forming expectations about it. Entrepreneurship in the true sense of the word implies inter-spatial or intertemporal arbitrage in the direct or indirect sense.²³ A successful act of entrepreneurship is fundamentally a discovery that a certain resource is undervalued in the way it is currently used and an action to purchase it to divert it to a use where it ends up creating more value as reflected in market prices for things it is used to produce.²⁴ An unsuccessful such act has the same underlying belief but the opposite result. All the neoclassical business cycle models are based on the construct of the general equilibrium

²³ Intertemporal arbitrage in the indirect sense happens when certain resources are diverted from one use and deployed to a different one with the hope that the future income will be higher than their current use generates.

²⁴ A classic source on the nature of entrepreneurship is Kirzner 1978 (1973).

(that can be intertemporal or dynamic stochastic), which implies that there can be no resources not utilized in the most productive ways.

It may be asked, though, to what extent innovation and entrepreneurship are relevant to studying booms and busts. Can we not just abstract from them for the sake of the bigger picture? There are several reasons why this seems unreasonable. First, unless we assume some completely exogenous mechanism behind the initial stage of the recession (like a war or a natural catastrophe), there should be some genuine entrepreneurial mistakes involved, like those made by the U.S. financial institutions that provided too much debt financing to housing construction and acquisition.

In addition to this, certain explanations of the crisis can be excluded or at least rendered implausible if innovation and entrepreneurship are taken into account. For instance, a temporary decrease in the aggregate demand accompanied by money hoarding can lead to a prolonged economic downturn within a framework in which the only way to affect consumer behavior is to modify the proportion of money and liquid financial assets held by consumers. However, as was mentioned above, innovative entrepreneurs may manage to come up with investment projects with high expected rates of profit and allow banks to make loans at higher interest rates than before. This may, in turn, allow banks to propose consumers higher interest rates on bank deposits and thus induce them to part with at least a certain part of the money they are hoarding.

This work strives to refine a theory of the business cycle that falls within the tradition of the Austrian School of economic thought. This tradition has always emphasized the need for consistent methodological individualism. In contrast to neoclassical economists who believe that they achieve this goal when they merely have a few aggregative choosing agents in their models, it always stressed the need to theorize in terms of multiple choosers that may have widely varying preferences and knowledge. It has also been based on the acknowledgment of the existence of irreducible uncertainty. It has also been arguably the only branch of economic thought that has developed an extensive theory of entrepreneurship. It is, hence, perfectly positioned to provide an alternative explanation to the business cycle phenomenon, even if the success of such an explanation is far from guaranteed. The following chapter will consider the intuitions underlying the theory of the business cycle that is in line with the Austrian School tradition and how the

previous efforts by the economists of the Austrian School to formulate such a theory square with those intuitions.

1. History of the Austrian Business Cycle theory, previous versions, and critique

1.1. The historical background and precursors to ABCT

When the economies of the Western societies started to rapidly develop in the late 18th century, they also started to experience periods of accelerated activity followed by declines. This prompted economists to start asking questions about the potential causes of this recurring phenomenon and whether it may be related to the functioning of the monetary system.

From the very beginning, we can roughly distinguish two major standpoints that were historically associated with different economic schools of thought. David Hume (1955 (1752)) arguably gave birth to the quantity theory of money that considered money as being relatively neutral as to economic outcomes. Hume and his followers correctly realized that the nominal amount of money in circulation as such does not have any direct relevance for economic outcomes. Whether an economy has a money supply of 1 million units or 10 million units over a certain period does not matter since what matters are relative prices among goods and both sizes of money supply will allow relative prices to adjust just fine. Later, some followers of Hume tended to make a wrong conclusion from this idea that if the amount of money changes, it will not have a significant influence on the configuration of economic activities, hence, the creation of additional money to stimulate economic activity, whose first deliberate proponent may have been the infamous John Law, is not going to do harm.

However, a contemporary of Hume Richard Cantillon (2010 (1730)) showed that, far from being neutral with respect to the composition of economic activities, changes in money supply will inevitably affect different parts of the economy differently, depending on which parts they affect in which order. For instance, if money supply increases, the first receivers of the newly available money will be able to purchase goods and services at prices that are lower than the level that they will attain later.

It may, of course, be objected that if the injection of additional money into the system is random, it will not have a measurable compositional impact. However, since monetary expansion usually happens through relatively large banks, it is improbable that they will randomly choose borrowers from all sectors of the economy, overall. Besides, in a complex economic reality with varying knowledge and perception, different economic agents, even working in the same industry, may, and often will, make different decisions with regard to investing the same amounts of newly available money. Finally, as will be shown further below, there may be factors systematically

favoring the allocation of added money supply to certain kinds of projects over others.

If we consider the investment activities undertaken in the modern economy, we may ask the question how the non-neutrality of money creation discovered by Cantillon affects their pattern, in particular through banks' lending money to enterprises that launch relatively long-term investment projects, and whether the distortions this channel of monetary influence may cause may have something to do with the recurrent economic fluctuations.

One intuitive way of responding to this question is to hypothesize that artificial money creation may stimulate long-term investment projects in a certain manner, despite there being no non-monetary basis for this. The opposite response would maintain that money creation may not distort the pattern of investment in a significant way.

However, before one attempts to assess the merits of these conflicting responses, there is an even more basic question that may be asked. Can banks that are ultimately responsible in the modern economy for bringing most new money into circulation actually create credit in excess of what productive enterprises genuinely need to serve the needs of consumers? It is obvious that if the answer to this question is negative, it automatically means that credit creation cannot distort the pattern of investment.

During the 19th century, two major schools of thought, the Currency School and Banking School,²⁵ developed diametrically opposed perspectives on this issue. The former school of thought originated in the writings of David Ricardo (1951 (1824)). The economists of the school generally believed that changes in the amount of money in circulation should be governed by the changes in the amount of metal used as the monetary standard. They were even opposed to free banking. The Banking School theorists (led by J. Fullarton (1845) and T. Tooke (1844)), on the other hand, held that note-issuing banks could not issue bank credit over and above the economy's needs. The Currency school partly won the debate in England resulting in the adoption of the Bank Charter Act of 1844 that prohibited private banks from issuing fractionally-reserved notes, although banks were still allowed to create demand deposits with fractional reserves.

The ideas of the Currency school centered upon the so-called 'currency principle' first formulated coherently by James Pennington, according to Rothbard.²⁶ The gist of the principle is

²⁵ For a detailed overview, of the respective schools of thought's positions, see, for example, Rothbard (2006 (1995), 225-270) for the English-language sources and Gentier (2002) for the French-language ones.

²⁶ Rothbard 2006 (1995), p. 231.

that only objects with a certain intrinsic value, like units of gold, can be considered as genuine money, and money substitutes such as bank notes and demand deposits can only be allowed to be issued or created in the total amount not exceeding the total amount of genuine monetary units. Whenever the amount of money substitutes exceeds that of the genuine money, it may be said that false money (*“fausse monnaie”*) is created.

Put differently, economists of the Currency School militated for the separation of money creation from banking. Banks, in this picture, were only supposed to perform the functions of facilitating settlements and lending out their proper money or funds received as term deposits. The economists of the British Currency School tended to favor the monopolization of money supply by a single privileged bank of issue, while their French counterparts adopted a free banking stance based on the observation that unfettered competition among private note-issuing banks would result in the inability of the banking system as a whole to over-expand the supply of the money substitutes.²⁷

Meanwhile, the adherents of the Banking School maintained that, in reality, banks were unable to durably expand money supply. In the early version of this view formulated by Fullarton, this was because loans created by the banks were temporary, and whatever money substitutes were brought into circulation through them had to eventually revert to the loan-originating banks. Later, this justification came to be replaced with the ‘real bills’ doctrine, according to which no inflation took place as long as banks “made short-term, self-liquidating loans matched by inventories of goods in process”).²⁸ As Rothbard noted, strangely, the Banking School theorists also favored the monopolization of money supply by privileged banks of issue.²⁹

The Currency school economists are directly relevant to this work because they were the first to realize that expansionary monetary policy could have distortionary effects on economic activity. They put forward the idea of “forced savings” according to which when new money is artificially created this often involves the redistribution of purchasing power from those who would have spent it on consumption during the given period to those who will allocate it to investment.³⁰ They set the stage for the economists of the Austrian School to apply this insight to the modern

²⁷ The question of whether credit creation by a free banking system is as prone as the system involving a central bank to artificially expand money supply is controversial but it is beyond the scope of this work. In both the theoretical and the empirical chapters, only credit expansion involving a central bank will thus be considered.

²⁸ Rothbard 2006 (1995), p. 244.

²⁹ Rothbard 2006 (1995), p. 245.

³⁰ Humphrey 1974.

economy using the apparatus of the modern economic theory.

1.2 The stylized facts of ABCT and the ABCT version types

The economists of the Austrian School have elaborated on the attempts to explain the business cycle made by their Currency school predecessors. The understanding of the heterogeneity of capital and the explicit treatment of production as happening in real time allowed them to conjecture that the boom phase of the cycle consisted in some sort of a temporary deviation of the pattern of production over time from the pattern of consumer demands. The deviation manifested itself in a cluster of investment projects being undertaken that later turned out to be unsustainable.

In general terms, the classical version of ABCT can be summarized as follows. In the normal circumstances in which voluntary savings are the only source of credit, the equilibrium loan market interest rate (gross market interest rate) stays equal to the natural (originary) rate of interest. The latter is defined as the equilibrium interest rate which would have been established if the lenders lent investors not money but intermediate goods directly. In the case of a credit expansion by the central bank, since the loan market interest rate falls below the natural interest rate, it becomes illusorily profitable for the producers to make the production pattern of the economy more capital-intensive.³¹

However, since consumers have not, in fact, changed their preferences in favor of abstaining from some consumption, the increased capital intensity of the production pattern turns out to be unsustainable when they attempt to readjust the production pattern back in line with their demands. Because the stock of scarce intermediate goods³² has not increased to enable the coexistence of the non-decreased consumption and a more capital-intensive production pattern, something has to give.

³¹Some economists of the Austrian School believe that credit expansion may also be caused by a concerted action of private fractional-reserve banks in an economy without a central bank. For the reasons provided by Selgin (1988, 80-82), we are skeptical of such a possibility. Nevertheless, even if decentralized credit expansion is possible, it does not impinge on the arguments made in this paper. They would apply equally well to such a case.

³²In this work, by “intermediate goods” we will mean all goods which are used in the production of final consumer goods. Intermediate goods are traditionally classified into capital goods and original factors of production (raw materials). While this classification is not without problems (for instance, it is difficult to classify electricity under it), in our view they are immaterial for the arguments put forward here.

The banking system can keep the troubled investment projects afloat for some time by accelerating the credit expansion and lending to them at even lower rates. But at some point, the central bank becomes concerned with inflation, which tends to increase because of the leakage of the additionally created money into the markets for consumer goods. It tightens the monetary policy stance, and banks cannot continue to accelerate lending to the unsustainably long production processes. As a result, those processes have to be frozen or abandoned.

Finally, because of the relative specificity of certain capital goods used in the troubled projects, it may be difficult or even impossible to reallocate them to the uses which better serve consumers. Thus, part of the capital of the economy becomes trapped or wasted, necessitating a temporary economic decline.

There are, thus, four key stylized facts to be incorporated into a sound version of ABCT:

- 1) Credit expansion leads to changes in the patterns of production in the form of projects that at some point lead to the reduction of the supply of certain consumer goods in favor of producing certain consumer goods later contrary to the preferences of consumers at that point in time.
- 2) This change in production patterns is driven by a cluster of investment projects that become illusorily more attractive to undertake and finance than before because of the credit expansion.
- 3) The originators of those projects commit genuine errors when they undertake them. In other words, their plans on which those projects are based are *ex ante* incompatible with the time pattern of consumer preferences, and the relevant projects would not be undertaken if their originators were aware of this incompatibility.
- 4) The unsound projects are incompatible with the time pattern of consumer preferences because at some point during the business cycle, they bid away certain resources from the production of certain consumer goods some consumers were expecting to be available at that point.

While all the existing versions of ABCT attempted to deliver a body of theory to make sense of these stylized facts, they have generally taken two approaches to the task. The first approach involves the use of the construct of the aggregate production structure (APS), whereas the second does not. Although these approaches, as they were attempted, were not completely incompatible, it is reasonable to consider them separately, while highlighting whatever similarities

exist between them.

1.3 The versions of ABCT based on the notion of the aggregate production structure

1.3.1 Overview

Most of the existing accounts of ABCT are built, in one way or another, around the notion of the APS. Among the versions of ABCT that follow this route, this work shall focus on the ones by F.A. Hayek (1967 (1931)), Roger Garrison (2001), Jesus Huerta de Soto (2006) and Mark Skousen (1990). Although these accounts differ in certain details, they are similar enough to be considered together, especially given that the focus of this work is not on the history of thought but on formulating a robust and empirically useful version of ABCT. Other literature in a similar vein that is not explicitly considered here includes *inter alia* Strigl (2000 (1934)), Machlup (1940), and Röpke (2007 (1936)). Attempts to formalize this approach to ABCT mathematically include *inter alia* Fillieule (2007) and Cachanovsky and Padilla (2016). Cachanovsky and Lewin (2014, 2016) attempt to provide a modern financial interpretation and basis for the notions of roundaboutness and the average period of production.

While Ludwig von Mises was the first economist to formulate a distinct account of ABCT in *The Theory of Money and Credit* (L. v. Mises 1953 (1912)), it was F.A. Hayek in his set of lectures on the structure of production (Hayek 1967 (1931)) who provided the first version of it utilizing modern terminology.³³ Hayek set the framework for future development of the theory by describing the APS as a succession of stages of production through which intermediate goods move until they mature into final consumer goods.

Put differently, the idea of the APS implies that at any moment in time intermediate goods are being produced with a varying temporary distance from the production of final consumer goods. The further a stage is from delivering finished consumer goods, the higher the order of

³³ For example, Hayek abandoned the reference to the classical notion of “subsistence fund” that features in the first formulation of ABCT by Mises (1953 (1912)). The reason for this is that already in the economy of Hayek’s time the issues of mere subsistence was becoming a thing of the past, and a more general notion of consumers temporarily sacrificing some of their needs was needed.

intermediate goods it is considered to produce. The highest-order intermediate goods, in this view, are raw materials like oil and iron.

For the sake of convenience, it is assumed that the products of each stage are sold by entrepreneurs at that stage to the entrepreneurs at the subsequent stage, although, in reality, vertically-integrated production processes may involve activities from the extraction of raw materials to final assembly. It is beyond the scope of this work to consider the question whether the simplification originally used by Hayek is particularly distortionary of reality since, as it will be demonstrated further, there are enough other probably insurmountable problems that the Hayek-inspired approach to formulating ABCT faces.

To more intuitively illustrate his ideas about the APS, Hayek used a triangular construction below.

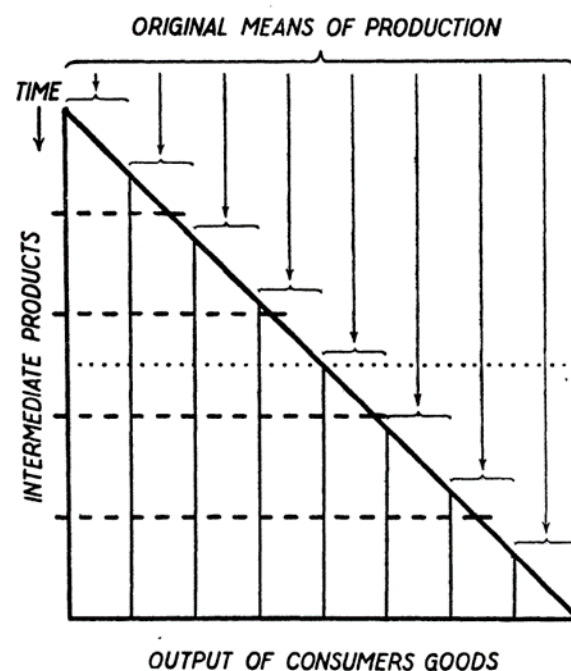


Fig. 1. The original Hayekian triangle.³⁴

Hayek describes the reasoning behind this construction thus:

For this purpose, I find it convenient to represent the successive applications of the original means of production which are needed to bring forth the output of

³⁴ Hayek 1967 (1931), p. 39.

consumers' goods accruing at any moment of time, by the hypotenuse of a right-angled triangle, such as the triangle in Fig. 1. The value of these original means of production is expressed by the horizontal projection of the hypotenuse, while the vertical dimension, measured in arbitrary periods from the top to the bottom, expresses the progress of time, so that the inclination of the line representing the amount of original means of production used means that these original means of production are expended continuously during the whole process of production. The bottom of the triangle represents the value of the current output of consumers' goods. The area of the triangle thus shows the totality of the successive stages through which the several units of original means of production pass before they become ripe for consumption. It also shows the total amount of intermediate products which must exist at any moment of time in order to secure a continuous output of consumers' goods.³⁵

Similar triangular constructions appear in the accounts by Garrison and Skousen. Skousen, in particular attempted to clarify what is not wholly clear in Hayek's account, namely, how the triangular scheme relates to the actual production processes, or, equivalently, what exactly is moving along the time axis, and whether the time axis reflects an actual succession of periods or a snapshot of various production activities taking place simultaneously. Skousen unambiguously chooses the latter interpretation:

To see this critical linkage, imagine for a moment that time is at a standstill, with everything and everybody suddenly frozen. If we were permitted to walk around and be bystanders, what would we see in this worldwide *snapshot* (emphasis mine – D. G.) of the economy?

Economists see things from many different perspectives but, from our current standpoint, we will discover that goods and services are at different stages of completion. We may notice first that goods are completely finished, having already been purchased by final users, and are now in varying stages of depletion. They are being used up or consumed.

³⁵ Hayek 1967 (1931), pp. 38-40.

Next, we may look at items currently being produced and those about to be sold to final users. We note that many goods in our snapshot economy are in retail department stores, grocery stores, car dealerships, and so on, and are ready for direct use by consumers. [...]

The automobile may be a good example of the snapshot economy that we envision in this time suspension. Millions of cars have already been built and are being used on the road today, in varying degrees of condition (some cars are old, some are new). Thousands of other cars are in the show rooms, ready to be purchased. Thousands more are in transit to the car dealers. Others are parked temporarily at the production plant waiting to be ordered by the car dealers. And still more are just coming off the assembly line.³⁶

De Soto does not make use of the triangular scheme, however, he turns to charts that appear to be based on similar logic, even though he concedes that “it is practically impossible to represent in this way the complex effects produced in the market when credit expansion triggers the generalized process of discoordination we are describing. Therefore, it is important to exercise great care in interpreting the following tables and charts, which should only be valued insofar as they illustrate and facilitate understanding of the fundamental economic argument. It is nearly impossible to reflect with charts anything other than strictly static situations, since charts invariably conceal the dynamic processes which take place between situations.”³⁷

All the APS-based accounts of ABCT then consider two scenarios of how the APS may change: one arising from an increase in voluntary saving and one driven by artificial credit expansion (that is ultimately the focus of this work). The logical structure of analysis here is often overlooked, although it is not trivial since, ultimately, the attempt is made to use static constructs to analyze both the equilibrium state of the APS and the transitions from one equilibrium to another induced by the external factors mentioned above.

Hayek and Garrison explicitly, and de Soto and Skousen implicitly, rely on general equilibrium constructs. Hayek was especially firm in his conviction that only equilibrium-based reasoning can account for the phenomenon of the business cycle:

³⁶ Skousen 1990, pp. 136-137.

³⁷ De Soto 2006, p. 353.

On the contrary, it is my conviction that if we want to explain economic phenomena at all, we have no means available but to build on the foundations given by the concept of a tendency toward an equilibrium. For it is this concept alone which permits us to explain fundamental phenomena like the determination of prices and incomes, an understanding of which is essential to any explanation of fluctuation of production.³⁸

The equilibrium APS is closely related to the state of the market for loanable funds, or in the more modern terminology, the credit market. Once the exogenous changes have worked themselves out, the aggregate interest rate in that market, on which the interest rates on individual loans are supposed to converge, equilibrates the supply of loanable funds (that may include either only the voluntary savings or voluntary savings plus the credit artificially created through credit expansion) with the demand for them.

In the undistorted picture where voluntary savings are the only source of the supply of credit the interest rate in the loan market is assumed to be equal to the natural (or originary) interest rate. The latter concept originated with Wicksell (1958 (1898)) and reflected the idea that money is only a means of exchange and loans could in principle be made in terms of actual goods. If loans were made in this way, they would ultimately reflect the same phenomenon as the actually realized loan market interest rate must reflect, namely, the rate of preference for present consumption vis-à-vis the future consumption.

Garrison (2001, 46) then explicitly claims³⁹ that in equilibrium the market interest rate equal to the natural interest rate enters the triangular APS construct as the tangent of the triangle, i.e. the slope of the hypotenuse. It also tends to equal the rate of profit, which is uniform for all stages.

The two scenarios of exogenous change considered in all the APS-based versions of ABCT both involve an increase in the supply of credit. If driven by changed savings behavior, the market rate simply mirrors the decreased time preference and also falls. This corresponds to the smaller slope of the triangle and a similar change in de Soto's charts. In the credit expansion scenario, the

³⁸Hayek (1967 (1931)), p. 225.

³⁹Garrison 2001, p. 46.

key difference is that the decreased market interest rate is out of sync with the actual time preference of consumers.

In both scenarios, it is claimed that it now takes longer for producer goods that start as the output of the higher stages to mature into the ultimate output in the form of consumer goods. It is now relatively more profitable to produce the goods of the higher stages than those at the lower ones. In the voluntary saving change case, this lengthening of the APS is sustainable and remains in place, unless further changes in time preferences occur. In the credit expansion scenario, however, the APS lengthening can be maintained only temporarily since, at some point, it must lead to a reduced supply of consumer goods. Since consumers' preferences have not changed, they will pull production away from the higher stages to the lower stages through reversing the distribution of profits between the two. Since the actual investment projects through which the unsustainable APS lengthening took place in part involve investment into capital goods of relatively high specificity, the APS cannot be frictionlessly brought back into its state before disturbance. Some capital is either permanently lost or will temporarily be unavailable, which results in reduced overall production and a shorter APS, and manifests itself macroeconomically in the familiar crisis phase of the business cycle.

This highly aggregative and abstract account of the business cycle raises several important sets of questions that need to be answered to establish its logical coherence and applicability to the actual economic realities:

- 1) Can all of the economy's productive activities be subsumed under the notion of an unchanged multi-stage flow of intermediate goods ultimately maturing into final consumer goods if the external factors stay unchanged?
- 2) What changes does this flow undergo in the two scenarios with the increased supply of credit?
- 3) What kind of resources are reallocated between the higher and lower stages whose scarcity ultimately renders the credit-expansion-driven long projects unsustainable in the credit expansion scenario? Where do these resources fit into the multi-stage flow?
- 4) Do the concepts of the aggregate natural and market rate of interest apply to the economic realities?

- 5) How does the APS picture correspond to the actual erroneously undertaken projects? How do they become more attractive both to undertake and to finance and how can the fact that genuine errors are committed when they are undertaken be reconciled with the use of general equilibrium constructs?

1.3.2 Can all the economy's productive activities be represented by a multi-stage APS?

The question that immediately arises with regard to the APS-based approach is whether it can actually adequately represent the ensemble of the economy's productive activities. At first sight, this does not seem to pose a major problem. For instance, the aforementioned example with the production process for automobiles that Skousen gives seems to align with this vision quite well.

However, even though activities like the production of automobiles can be represented this way, there are other important activities that do not seem to be easily reconcilable with it. First, even though Hayek decided to disregard the creation of durable capital goods like the construction of new plants or hotels or the expansion or modification of the existing production facilities, it constitutes an important part of the economy, especially during the periods of economic boom. The creation of durable capital goods is not clearly reconcilable with the APS scheme because the relevant projects do not involve maturing of goods-in-process over a succession of stages where more of the goods-in-process are produced at the early stages. Of course, it may be claimed that for instance, a building in the process of construction looks a lot like a good-in-process. However, if there is a more or less contemporaneous cluster of durable capital good production projects during a savings-induced change or credit-expansion-fueled boom, only in the beginning of the process will most of the buildings under construction be at the early stage. In other words, a cluster of construction projects does not result in a uniform change in the multi-stage APS until its completion or the crisis point.

However, it may be objected that, while a cluster of durable capital good production projects does not fit neatly into the triangular or a similar scheme, the underlying idea that its appearance temporarily results in a more roundabout production structure still stands.

The concept of roundaboutness originated with Eugen von Boehm-Bawerk (1930 (1889)). Hayek made particularly strong claims involving it, as, for example, in this passage:

The *raison d'être* of this [more roundabout] way of organizing production is, of course, that by lengthening the production process we are able to obtain a greater quantity of consumers' goods out of a given quantity of original means of production. It is not necessary for my present purpose to enter at any length into an explanation of this increase of productivity by roundabout methods of production. It is enough to state that within practical limits we may increase the output of consumers' goods from a given quantity of original means of production indefinitely provided we are willing to wait long enough for the product.⁴⁰

What Hayek meant was that the increased roundaboutness of a production process of a given consumer good implies that it now takes longer to turn certain initial inputs into units of that consumer good but this is compensated by the fact that the same amount of the initial inputs in question allows producing a lot larger amount of the final consumer goods.⁴¹ Logically, for investments into more roundabout production processes to be profitable the increase in production that they bring must be relatively larger than the increased duration of the average period of production.

While this idea seems quite plausible, it quickly becomes clear that it does not apply to a large part of investment projects aimed at enhancing productivity. Skousen in his simple Robinson Crusoe-style hypothetical⁴² inadvertently illustrates this point. By foregoing some leisure to accumulate a fish stock, a lonely man on an island can sustain himself for several days while he works on a net that then enables him to permanently increase the production of fish after it is completed. In this hypothetical scenario, the process of catching fish has not actually become permanently longer, or more roundabout. Rather, at some point, the stranded man needed to wait longer for new fish to be caught, but once the net is available, it takes the same time or perhaps

⁴⁰ Hayek 1967 (1931), pp. 37-38.

⁴¹ Interestingly, the APS-based versions of ABCT have not, to the knowledge of this author, considered the very real possibility that, instead of leading to quantitative increases in production of certain final consumer goods per period, more roundabout production processes may use the same inputs to deliver more valuable consumer goods of the same or similar kind or even completely different final consumer goods that are valued more highly by consumers than the original final consumer goods the relevant inputs were used to produce. However, as will be shown below, the APS-based versions fail to explain how more roundabout processes may fail, regardless of what kind of improvement at the expense of longer duration they bring.

⁴² Skousen 1990, p. 219.

even less time, than before, to obtain it. Skousen attempts to deal with this issue while considering the critiques of Boehm-Bawerk by those economists who noted that innovation involves investment into new capital goods (like Henry Ford's assembly line for automobiles) that then often dramatically shorten the time needed for producing final consumer goods.

Skousen (1990, 217) acknowledges that investment into such capital goods involves two stages: "first, there is the building of the capital good, and second, the increased productivity that follows its implementation."⁴³ He also concurs with the critics of Boehm-Bawerk that the notion of increasing roundaboutness that involves permanent lengthening of the waiting time (average period of production) taken as a general consequence of investments aimed at increasing productivity is untenable in view of their criticisms. However, he then proceeds to note that there is still a trade-off involved in adopting the new techniques and the savings needed to further that goal, which, according to Skousen (1990, 222), "validates Boehm-Bawerk's position."⁴⁴

In this new reading, Boehm-Bawerk's position implies that the average period of production increases only for the period during which the new techniques are being implemented in the relevant capital goods being built, and then decreases when (if) their implementation is completed. However, consumers may put pressure on the prices of inputs used in the relevant projects too early thus putting them into financial trouble. This interpretation is sound but somewhat narrow. Innovations may involve not producing the same good in greater amounts over the same period of time (like Ford's breakthrough allowed to do with automobiles) but also just to the production of new, more valuable goods and services. In addition to this, Skousen does not address the problem that these examples do not involve intermediate goods in the process of maturing that change hands but are, instead, vertically integrated. Skousen could, of course, respond that this is not fatal but it actually seems to be. His explanation for why the lengthening of the APS takes place is that it becomes more profitable to produce goods at the higher stages, however, in vertically integrated contexts, this obviously may not be the case.

Most importantly, even Skousen's attempted reconciliation of the concept of roundaboutness with the realities of innovation does not appear to square well with the multi-stage APS-based view of the business cycle. The projects in question may not involve more stages than

⁴³ Skousen 1990, p. 217.

⁴⁴ Skousen 1990, p. 222.

some other investment projects in the economy. They also do not have to imply increased production of any particular kind of intermediate good that is sold to other stages before the projects are actually completed. For instance, if we assume that the malinvestment phase of a business cycle consists of a cluster of new large hotels being built, this may reallocate cement, other raw materials that are used in construction, and the construction equipment towards the construction of large hotels but the overall production of those inputs may not increase at all. Therefore, even if the long list of deficiencies of the APS approach discussed above could be overcome, it would still only apply to some instances of credit-expansion-driven malinvestment.

In addition to projects involving the formation of durable capital, even certain activities not involving it do not seem to fit into the APS-based scheme as a general description of all the productive activities taking place in an economy because their final products can be both final consumer goods and intermediate goods. For instance, the production and delivery of electricity involve seemingly similar multi-staged pattern to the production of automobiles. However, electricity is used both directly by consumers and by lots of productive activities that do not immediately result in final consumer goods.

Related to the latter point is the problem that the classification of all intermediate goods into those produced at higher and lower ones in an absolute sense does not withstand scrutiny, if we set aside the very simple Robinson Crusoe – style hypotheticals, because, the products of seemingly lower stages are frequently used to produce the products of supposedly higher ones. For instance, much of electricity in the modern economy is produced using fossil fuels like oil and natural gas but the equipment used to extract them and deliver them to power plants is largely electricity-powered. Hence, the notion of a sequence of stages that are temporally closer and closer to the final consumption is incoherent.

Skousen acknowledges this critique but claims that it is sufficient to take as a starting point for the time dimension of an intermediate good-in-process the moment at which the project of its production started. As an example, he suggests that if we want to determine the maturity of a portion of flower, we need to just trace it to the moment when the wheat from which it came was planted.⁴⁵ In line with this approach, it does not matter that some input used in the production of flower may also be used in the extraction of raw oil, thus belonging to both a higher and a lower

⁴⁵ Skousen 1990, p. 98.

stage at the same time in the APS scheme. The thing that matters is that one of the consumer goods-in-process – wheat – takes a longer route from the field to the supermarket.

Here Skousen could have said explicitly that this leads to the partial preservation of the APS-based reasoning provided that its excessive aggregation is dispensed with. Namely, he could have claimed that the pattern where increased roundaboutness means that more time elapses between the obtainment of certain initial (higher-stage) inputs and their transformation into final consumer goods does not apply to the ensemble of the economy's production activities but merely to those of them that resemble automobile production the snapshot of which he sketched in the quote above. Thus, even though we cannot talk about an increase in the average period of production for the economy as a whole, we may be able to talk about it with respect to all the automobile-production-like production processes, provided that the changes take the form just described.⁴⁶

The first problem with this response is that it is based on a questionable decision to apply staging only to some inputs (like, for instance, wheat) and not others like electricity. But even if this is set aside, this solution appears to be unsatisfactory for salvaging the APS scheme, which can be illustrated with a hypothetical example. Suppose that the change in question happens through adding to the process of turning wheat into bread a special grain processing stage that was not part of the process before and that the addition of this stage, while costly, renders the resulting bread much more nutritious and appealing to consumers. Clearly, we cannot just consider this lengthening of the average duration of the time lag between the harvesting of a wheat grain and its incorporation into a loaf of bread on a supermarket shelf and thus conclude that the average duration of all the production processes that can be described this way has increased. We also have to consider which inputs the addition of the wheat processing stage diverted and from which other production processes. This reallocation of inputs may well make certain stages of some other production processes untenable, thus offsetting the effect of the bread production lengthening even in the sense of the average process duration.

⁴⁶ The kinds of changes to such production processes that would not qualify here are, for instance, the previously-discussed investments into durable capital that, once completed, accelerate the relevant processes. One of the most vivid examples of such investments is Ford's introduction of the assembly line into the production of automobiles.

Alternatively, suppose that the lengthening of an automobile-production-like production process takes place not by making the resulting product more valuable at the expense of more time elapsing between the obtainment of the raw inputs and their ripening into final product but through allowing much more final product to be available by the end of each production period. This is perhaps the best way of making sense of what the authors of the APS-based versions of ABCT had in mind. Still, ultimately, after the very first prolonged production period ends, there is no need for the waiting time to increase permanently because more of the relevant final consumer goods are now available for the following production period after a given preceding one. Hence, even though the time elapsing between the obtainment of certain first-stage inputs and their ultimate transformation into final consumer goods may indeed increase, it does not have to result in consumers continuously having to wait longer to consume the relevant goods.

Secondly, it is unclear how many real-world changes in production processes actually follow this scheme. It may be argued that most production process changes in the real world happen through the creation of new production facilities and equipment, after which production more often than not is accelerated, and the difficulty of squeezing this kind of changes into the APS scheme was already discussed above.

Finally, and perhaps more importantly, it is unclear how such changes, even where they may take place, may have the consequences implied in the notion of the boom and bust cycle. If starting from a certain moment, it takes four weeks instead of three on average to incorporate a grain of wheat into a loaf of bread but the resulting loaves are more nutritious, there is no clear temporary impact on consumer preferences even far down the road. Consumers may purchase fewer loaves per period but they may receive the same number of calories from them, and thus there does not need to be any reversal of this change. Hence, there is no obvious temporary reduction in consumption that has to happen at some point during the APS lengthening, whether this lengthening is induced by an increase in savings or a round of artificial credit expansion.

In addition to the aforementioned issues, a less important avenue of critique is that even if the totality of the productive processes at a particular snapshot were representable by the APS scheme, the APS-based approach implies that the APS remains unchanged during a certain period after the initial external influence (be it through increased saving or credit expansion), as the projects aimed at making certain production processes more roundabout are being undertaken, and

before they are either completed or rendered unsustainable in the case where lengthening is due to credit expansion. Hence, you may represent the initial change until the bust as a single instance of lengthening.

A simple hypothetical may illustrate that this is untenable. Suppose that credit expansion had triggered some investment into the development and production of a new fertilizer for wheat, which once it reached the stage of higher wheat yields, also resulted in the need for more fuel for harvesters, which in its turn reduced the amount of fuel available for consumers, namely, car drivers. It is clear that during the process the pattern of production did not remain the same between the moment the fertilizer started to be developed and its utilization in wheat-growing. Initially, what got reallocated was just R&D, then R&D was not needed anymore, then certain inputs needed to be reallocated from other activities to produce the fertilizer, and only then did fuel need to be redistributed from driving. In the APS picture, all this would need to be somehow squeezed into a single instance of lengthening, ideally representable graphically or mathematically.

1.3.3 The aggregate market rate of interest and the natural interest rate

Even if the issues discussed in the preceding sections could be overcome, there is another potentially contentious element in the APS-based approach. In particular, the APS-based accounts posit that there is a true underlying interest rate (natural rate of interest in most of the versions) that, in the given conditions will tend to equalize savings and investment. However, the loan market interest rate may be caused to deviate from the former by credit expansion.

The lowered market interest rate is assumed to fuel the malinvestment pattern through changes in the valuation of capital goods because the cost reductions for the credit-expansion-driven long projects caused by the lower interest rate are relatively larger than for the shorter-term projects.

The construct of the natural (originary) interest rate at least in the business cycle context gives rise to at least two major objections. First, it is not clear what an interest rate could even mean if lending happened directly in intermediate goods. Since those goods would be used in the production of other goods, it would have been impossible to repay the loan in units of the originally lent goods. Thus, the notion of an interest rate ceases to make sense. Another problem first noted

by Straffa (1932) and discussed in some detail by Murphy (2011) is that even if the notion of the interest rate as applied to lending in the units of intermediate goods made sense, each lent intermediate good would have its own natural rate of interest.⁴⁷

The notion of a single loan market interest rate is also of dubious utility because of the real possibility of price discrimination that is not even limited to that on the basis of different levels of risk exhibited by different projects. To provide a hypothetical example, there may be two kinds of projects in an economy: those that promise a 7% rate of profit and those that promise a 10% rate of profit. Let us suppose, for the sake of simplicity, that both categories of projects are financed entirely by borrowing. If each of those categories of projects requires fewer funds than the banks in this economy possess, then some banks will only be able to finance the projects offering the prospect of a 10% profit rate. The originators of the more promising projects may be prepared to pay 5% of interest on bank loans but those of the less promising projects may not be. This opens the possibility of price discrimination for the banks, just as it does, for instance, for airlines in relation to wealthier and less wealthy clients. It could, of course, be argued that, in contrast to the airline business, banks do not constantly differentiate their services in a meaningful way, hence one bank could just capture the market through offering the same interest rate lower than 5% for both types of projects. However, in reality, any such single rate could be too high for some projects, hence even banks competing on price would have to negotiate with their borrowers. It is here that the cost of negotiation comes in, as well as the very real possibility that there may be not enough credit for all projects. Many project originators would certainly prefer to be able to launch their projects earlier than later or to even get the money by paying somewhat higher interest rates if they expect their projects to be more profitable than some other projects in search of credit.

It is also important to note that monetary expansion through the credit channel does not have to result in lower interest rates. At any moment, there are certain investment projects that are not feasible because there are other projects that banks deem to be more attractive for one reason or another at the same interest rate, and that the relevant originators are not prepared to undertake at higher interest rates. As additional funds become available, banks may become able to finance

⁴⁷ Note, however, that Murphy is only able to provide an example which makes sense because he focused on the case of a hypothetical economy with two consumer goods that can be exchanged *inter alia* for claims to future amounts of those same consumer goods. It is possible to set the interest rate in terms of a unit of a lent good if one borrows apples and produces apples, but it is difficult to see how an interest rate can be set in units of, for instance, oil if one is producing synthetic clothes.

such projects at the same interest rates as some projects that they chose to finance instead previously. Hence, a distortion of the investment pattern may well happen without major changes in interest rates, especially in the average interest rate.

In addition to this, the invocation of a single market rate of interest obscures the important difference between interest rates on bank deposits and those on investment loans. Consumers in the modern economy are not in the conditions faced by the stranded man in the above-mentioned Skousen's hypothetical example with foregoing some consumption of fish to produce a net to catch a lot more fish afterward. Rather, they receive benefits from their increased savings indirectly through returns on their savings that can take the form of higher deposit rates that banks are able to pay because they are financing genuinely longer investment projects. It is these increased deposit interest rates that can incentivize consumers to save more. In other words, in the modern economy, it is not the consumers that randomly start saving more but the banks that induce them to do so because entrepreneurs have come up with different kinds of long-term projects.

If interest rates on deposits are decoupled from those on loans, this allows to avoid the thorny issues raised by the claim that credit expansion can result in both increasing consumption and investment that Garrison represents as movement of the economy beyond the production possibilities frontier⁴⁸ and that Hayek relies on to resolve the input prices problem discussed in the next section. Even in the case of credit expansion, where banks can create additional credit without enticing consumers into saving more, this does not necessarily mean that banks will reduce interest rates on deposits. Hence, no decrease in voluntary saving and no corresponding increase in consumption has to take place in the credit expansion scenario. The increase in consumption alone may take place, however, in the context of genuine innovation-driven growth, if it accompanies the boom.

1.3.4 What gets redistributed in the case of the APS lengthening?

⁴⁸ Garrison 2001, p. 69.

Another important challenge for the APS-based approach is to pinpoint the source of physical scarcity that must be operative at the stage of the business cycle when the credit-expansion-driven long projects are found to be based on a flawed calculus. Without such scarcity, it is unclear how those projects could become compromised but the multi-staged APS-based approach results in the need to squeeze all the productive activities into a single multi-stage structure, in which every intermediate good must be produced at some stage. However, if an intermediate good in the APS scheme is produced at some stage it cannot be redistributed towards any other stage, except the stage immediately following the former.

The difficulties are especially evident in Hayek's repeated conflation of the value and the physical amount as the dimension of the base of the triangle. When initially describing the triangle, he claims that it denotes market value, "The bottom of the triangle represents the value of the current output of consumers' goods."⁴⁹ However, several pages further, he claims that it is not just value that is transferred along the stages but also physical volumes of goods.

Probably the simplest method of transforming the picture of the continuous process into a picture of what happens in a given period is to make cross sections through our first figure at intervals corresponding to the periods chosen, and to imagine observers being posted at each of these cross cuts who watch and note down the amount of goods flowing by.⁵⁰

This was probably caused by the idea that the APS will (at least in equilibrium) distribute the production of goods among various stages according to the natural interest rate which shall be discussed below. In other words, Hayek's approach tends to conflate the redistributed production and redistributed input use because his account was supposed to be true both of the monetary aspect of the economy and the aspect involving the real trade-offs between using resources for current consumption and providing for higher future consumption.

In such a case, the proportion of money spent for consumers' goods and money spent for intermediate products is equal to the proportion between the total demand for consumers' goods and the total demand for the intermediate products necessary for their continuous production; and this,

⁴⁹ Hayek 1967 (1931), p. 40.

⁵⁰ Hayek 1967 (1931), p. 43.

in turn, must correspond, in a state of equilibrium, to the proportion between the output of consumers' goods during a period of time and the output of intermediate products of all earlier stages during the same period.⁵¹

[...] Now it should be clear that to this change in the distribution of the amounts of money spent in the different stages of production there will correspond a similar change in the distribution of the total amount of goods existing at any moment. It should also be clear that the effect thus realised,—given the assumptions we are making,—is one which fulfills the object of saving and investing, and is identical with the effect which would have been produced if the savings were made in kind instead of in money.⁵²

The conflation of the purely physical and value dimensions of the triangle is also evident from this quote: “Now it should be clear without further explanation that the proportion between the amount of intermediate products (represented by the area of the triangle) which is necessary at any moment of time to secure a continuous output of a given quantity of consumers' goods, and the amount of that output, must grow with the length of the roundabout process of production.”⁵³

It was already mentioned above that it is not the case that the products of one supposedly clearly identifiable stage of production are only used by the supposed lower stage but even if this is set aside, changing patterns of production do not result in physical changes in production of the sort envisaged by Hayek. For instance, if the increased production of textile fabrics requires increased use of water, water will not actually be incorporated into the additionally produced fabrics. Suppose that fabrics are used for producing clothes later on and water is redistributed towards the production of fabrics from heating homes that can be considered as being closer to final consumption than the former. This does not mean that the physical volume of production at the higher stage of fabric production has now increased by the amount of water that was redistributed towards it.

⁵¹ Hayek 1967 (1931), p. 46.

⁵² Hayek 1967 (1931), p. 51.

⁵³ Hayek 1967 (1931), p. 41.

Even if we disregard this problem, the Hayekian triangle picture with redistribution of the volume of production towards investment seems to be one immediately involving underconsumption and overinvestment. However, the core idea about ABCT is that it is supposed to explain empirical episodes of malinvestment that are often actually accompanied by rising consumption, not overinvestment.

Hayek initially appears to endorse the overinvestment approach, “In the same way, in the case we are now considering, the use of a larger proportion of the original means of production for the manufacture of intermediate products can only be brought about by a retrenchment of consumption.”⁵⁴ However, he soon admits that it is actually possible for the credit expansion scenario to not initially involve a reduction in consumption:

Now, contrary to what we have found to be the case when similar processes are initiated by the investment of new savings, this application of the original means of production and non-specific intermediate products to longer processes of production will be effected without any preceding reduction of consumption. Indeed, for a time, consumption may even go on at an unchanged rate after the more roundabout processes have actually started, because the goods which have already advanced to the lower stages of production, being of a highly specific character, will continue to come forward for some little time.⁵⁵

This *ad hoc* solution does not appear to be satisfactory, though. In order for ABCT to be able to explain actual business cycle episodes, it must allow for the credit-expansion-driven long projects to be undertaken for several years before they face problems. It is highly implausible that at the beginning of the cycle there is a stock of semi-manufactured consumer goods at various stages that can suffice to compensate for the effects of the malinvestment because production processes do not take anything close to years to turn semi-finished goods into finished ones.⁵⁶ Hence, the only alternative explanation of how credit expansion may not initially reduce consumption is that the credit-expansion-driven long projects for some reason do not initially take

⁵⁴ Hayek 1967 (1931), p. 57.

⁵⁵ Hayek 1967 (1931), p. 87.

⁵⁶ Even producing something as intricate as a Rolex watch only takes about a year, according to Adams (2015), and this is probably an extreme outlier.

resources away from consumer good production or at least may not do it to a sufficient degree. It will also be shown below that in this realization lies the solution to the conundrum of genuine errors involved in the kinds of malinvestments ABCT purports to throw light on. Hence, the question of what resources get redistributed among stages as opposed to volumes of production is the crucial question with regard to the physical scarcity that ultimately renders the malinvestment boom untenable.

Hayek initially seems to imply that producers at various stages compete amongst themselves only for what he calls “the original factors of production” by which he means labor and land. De Soto expanded the notion of the original factors of production to also include other natural resources.⁵⁷ Skousen does not explicitly address this issue in his account.

Hayek, however, seems to suggest elsewhere that there are also certain producer goods that are redistributed: “But this cannot go on. When the reduced output from the stages of production, from which producers' goods have been withdrawn for use in higher stages, has matured into consumers' goods, a scarcity of consumers' goods will make itself felt, and the prices of those goods will rise.”⁵⁸

Garrison attempted to resolve the issue by suggesting that in the credit expansion case, resources are being pulled away from the middle stages in favor of increased production at both the higher and lower stages.⁵⁹ However, this implies that the production of certain important finished consumer goods may not require input from the middle stages of production for some time but the input it will eventually require to be sustained involves the same resources as those that were used to initially expand it without the middle stages' input in approximately the same amounts. This seems to limit the applicability of ABCT to certain very special cases of production.

It should be noted, however, that if the APS-based approach is abandoned, the need to explain the relationship of the inputs for which the credit-expansion-driven long projects unsuccessfully compete with the projects that are closer to catering to current consumption to the structure of stages does not remain. In a non-APS-based version of the theory, it suffices to say very generally that certain kinds of projects compete with some other kind of projects for certain

⁵⁷ De Soto 2006, p. 294.

⁵⁸ Hayek 1967 (1931), pp. 87-88.

⁵⁹ Garrison 2001, p. 72.

goods and services. The latter may be raw materials and labor but they can also include things like electric power or artificially produced chemicals. A theory free of the shackles of the APS scheme can accommodate a wide range of cases and be more faithful to the complex modern economic realities.

1.3.5 How do the actual credit-expansion-driven long projects fit into the picture? The issues raised by equilibrium-based reasoning and genuine errors

The final major issue with the APS-based approach to ABCT is its compatibility with the key stylized fact that ABCT is supposed to explain, namely, that at the core of the business cycle is a cluster of erroneously undertaken projects (lasting for several years) that are based on genuinely mistaken assumptions. The first thing to be explained with regard to those projects is how credit expansion leads to their being undertaken at all. It actually implies two sub-questions:

- 1) Why do certain entrepreneurs decide to launch the relevant projects in the case of credit expansion?
- 2) Why do banks decide to allocate the newly available credit to them?

The difficulties with regard to both sub-questions depend on the strength of the claim being made. In some cases, the APS-based accounts seem to imply that credit expansion by the central bank will necessarily result in erroneous lengthy processes being launched. In this case, it is sufficient to point out that in the actual historical episodes of credit expansion not the whole or even most of the artificially created credit was allocated to the kind of projects envisaged by ABCT. For instance, the bulk of such credit during the latest expansion stage of the business cycle in the US went to finance the construction of 1-4 family homes, as will be shown in chapter 5. However, even the weaker claim that at least a substantial part of the artificially created credit will tend to be channeled into longer investment projects still raises the two aforementioned questions.

A response appearing in several of the APS-based accounts lies in the changing profit structure across stages. All the APS-based versions rely on the idea that an increased supply of credit – whether in the normal or the credit expansion scenario – leads to a set of changes to the profit structure among the stages of production. However, as was mentioned above, there is a potential confusion here between genuinely long-term investment projects like those of building

plants and processes of production serving intermediate goods for those projects. The former may not result in any profits for years, while the profitability of the latter may indeed increase at some point after the appearance of the additional credit but does not have to. Thus, it needs to be answered how credit expansion makes ABCT-envisaged projects more attractive than before.

One solution may be that the credit-expansion-driven long projects that make more use of the products of the higher stages than before are started because of the interest rates that are either lower in an absolute sense than before or lower for such projects than before. Indeed, Skousen argues that longer-term projects are more affected by changing interest rates because the mere fact that they take more time to complete makes them subject to paying more in interest costs at the same rate of interest.

This makes such projects *ex ante* more profitable for their undertakers and partly answers the first sub-question above, however, it remains unclear why banks would necessarily choose to use newly available credit to finance exactly such projects. After all, the actual profitability of such projects compared to the past has not changed, and they thus have not become more attractive to finance than before. At the same time, there may be shorter projects available for financing that were not attractive before but now have become more attractive than in the past and more attractive than the longer ones. Overall, the question why banks would finance longer-term projects appears to have eluded all the authors of the preceding versions of ABCT. Answering this question seems to necessitate abandoning or at least deemphasizing the APS-based approach.

The idea that more roundabout projects are necessarily more productive could seem to provide a solution here but it was already shown above that the notion of roundaboutness employed in the APS-based accounts of ABCT is problematic, and that Skousen's attempt to salvage it fails. Most importantly, even if this notion were not flawed, it would not resolve the issue of how credit expansion makes banks more willing to finance the projects that were already innovative before the credit expansion but not worthy of lending to from the banks' perspective. Even with the additional credit becoming available for lending out, it may still be more profitable for banks to finance investment activities that will merely redistribute production among the currently existing production methods. For instance, it may allow banks to finance the construction of more housing through mortgages, which usually does not qualify as longer-term projects in Skousen's sense

because the completion of much of housing does not take several years, as the expansion stage of the business cycle that needs to be explained does.

It is also interesting that some investment projects that are not genuinely innovative (i.e. do not introduce new techniques of production) and, hence, only involve the redistribution of investment activities among the already existing techniques may actually result in the undertaking of the kind of projects that ABCT needs to explain. One only needs to recall the example of the CityCenter project in the Preamble. ABCT must provide a unified explanation of why both genuinely innovative projects and the projects like CityCenter are started too early.

Skousen proposes another explanation as to why it is the ABCT-envisaged projects that will tend to receive the additional credit, in whichever way it becomes available. According to Skousen, since the expansion occurs through credit markets, an economic expansion will primarily occur in the intermediate or higher-order industries where big borrowers exist.⁶⁰ It is not obvious what Skousen means here. For instance, the chain of supermarkets Walmart is a very large enterprise that could potentially borrow a lot of money but it is active in retailing which is not a higher-order industry. One possible interpretation is that Skousen implies that lower interest rates will primarily affect the demand for credit in the higher-order industries because it is there that the value of capital goods like mines is the most affected by lower interest rates, given how much time it takes to create such capital goods.

However, even this solution does not seem to rescue Skousen's reasoning. After all, building a big mall may, in principle, take more time than opening a new mine, even though mall-building relates to retailing, which, as we have seen, is not a higher-order industry. The same observation can be made about large logistical centers for the distribution of consumer goods, hotels, casinos and so on. And obviously, since lower interest rates directly influence the perceived profitability of projects depending on their expected duration, if the construction of a mall takes longer than that creating a mine, lower interest rates will boost the former more.

The second part of the key stylized fact to be explained by ABCT is that the projects started because of the credit expansion must somehow involve genuine errors made by their originators.

⁶⁰ Skousen 1990, p. 286.

This, however, is apparently in conflict with the fact that all the APS-based versions of ABCT rely on general equilibrium constructs.

As was mentioned above, Hayek states explicitly that Walrasian equilibrium-based reasoning is the only reliable way of making sense of what happens in the economy in general and during the business cycle in particular. In this approach, a production structure without external disruption will be in equilibrium, such that the rates of profit at each stage will tend to be the same and equal to the natural interest rate. When an increase in savings or a round of credit expansion takes place the equilibrium is disrupted and the system starts moving towards the new equilibrium. Although it is clear what this process implies for Hayek in the case of a savings increase – the APS becomes elongated and the profit rates fall at every stage – even then it must be noted that the state of the lengthened APS is not really an equilibrium one. The definition of an equilibrium implies that once the external changes have exerted their effects, the system stabilizes and no endogenous changes can happen. However, after some time during which a lengthened IPS remains stable, it becomes possible to produce more final consumer goods than before. In the credit expansion scenario, the problem is even more obvious. First, the APS enters a state in which unjustified lengthening of the production structure (or its simultaneous pulling in two directions, as per Garrison) takes place, which is followed by the shortening of the APS once the lengthening becomes unsustainable. The switch from the first state to the second does not have to be caused by some external factor (although in practice, it may be ushered in earlier by, for instance, the monetary tightening by the central bank), hence the temporary lengthening state may not technically be considered an equilibrium. At the same time, the Walrasian framework can only analyze movements towards equilibrium. De Soto, Garrison and Skousen do not explicitly outline the equilibrium constructs that they are (implicitly or unconsciously) using but their reasoning seems to be wedded to equilibrium. Even de Soto, who has elsewhere (De Soto 2008) expressed opposition to the not-genuinely-dynamic equilibrium constructs reasons in terms of external changes and price and project adjustments in response to them when dealing with the business cycle.

A higher-level flaw in the attempts to apply equilibrium-based approaches to the business cycle, that consists in there being a (by definition) non-equilibrium phase that has to be treated as

if it were an equilibrium one, has a closely related lower-level counterpart. What all equilibrium constructs have in common is that agents' plans in them cannot be *ex ante* incompatible.

They must be rendered compatible before their implementation. More specifically, the equilibrium context precludes simultaneous implementation of projects that are initially capable of being implemented, despite implicitly competing for certain resources, but then become unsustainable because of that very competition. If the equilibrium-based approach is to be maintained, the projects that are incompatible in this way must be adjusted *ex ante* so that they become implementable simultaneously till completion. However, in this case, the cluster of errors caused by credit expansion the explanation of which is the goal of ABCT disappears.

In the case of the APS-based versions of ABCT, this problem manifests itself when the prices of goods for which the projects resulting in APS lengthening compete with other productive activities are taken into account. If we treat the phase where lengthening occurs as an equilibrium state - as we are forced to by the equilibrium-based reasoning - it means that the prices of those goods must immediately reflect the increased amount of money chasing them, and rise. But this will tend to cancel out the illusory profitability of the longer projects, counteracting the effect of the lower interest rates they face.

Hayek seems to have been on the verge of discovering this issue but stopped short by only considering how the longer projects can bid away resources from the competing activities, without taking into account the impact of such competitive bidding on the illusory profitability of the former:

At first sight, it might seem improbable that these borrowers who were only put in a position to start longer processes by the lower rate of interest should be able to outbid those entrepreneurs who found the use of those means of production profitable when the rate of interest was still higher. But when it is remembered that the fall in the rate will also change the relative profitableness of the different factors of production for the existing concerns, it will be seen to be quite natural that it should give a relative advantage to those concerns which use proportionately more capital.⁶¹

It may be objected here that Robert Lucas (1977) provided an equilibrium-based solution

⁶¹ Hayek 1967 (1931), p. 86.

to the problem of business cycles that involves prices not allowing perfect coordination but not leading to genuine errors. Lucas hypothesized that in the case of a monetary policy-induced change in prices, agents may have a hard time deciphering whether the change in question is caused by inflation or reflects a changed demand for their product, and there is a certain probability that they will make mistakes in this regard. In the case of inflation, some producers may thus believe that the demand for their products has increased and mistakenly invest into boosting production, while, conversely, in a deflation scenario, they may reduce production instead of reducing prices. However, whatever the merits of Lucas' hypothesis,⁶² which has certain similarities with Gimenez-Roche's version of ABCT discussed in the next section, it does not resolve the particular problem input prices pose to the equilibrium-based versions of ABCT since in Lucas' hypothetical prices change from the start while they may not if the business cycle scenario is to take place.

1.4 The versions of ABCT not based on the APS construct

In the preceding section, we looked into the APS-based versions of ABCT and found them wanting for a number of reasons. However, perhaps, the existing versions of ABCT that are not explicitly or implicitly invoking this scheme may do the trick for illuminating the business cycle phenomenon? This volume will focus on three accounts of ABCT that qualify: the one proposed by Mises in his treatise *Human Action* (L. v. Mises 1963 (1949)), the recent contribution by Giménez Roche and the credit-search-based model by Dong, Wang and Wen.

1.4.1 Mises' version of ABCT in *Human Action*

⁶² First, it is implausible that producers would respond to people being prepared to pay more for the product by randomly guessing whether this is due to inflation or genuine preference change. Producers, after all, are not automatons responding to signals mostly invest in marketing surveys and can use other information to see whether there has been a preference change. Secondly, since the guessing suggested by Lucas is implicitly considered to be optimal, one may wonder whether we should actually consider economic crises as crises rather than say sort of insurance costs. Of course, it may be argued that what we call 'crises' tend to be made worse by governments but then should the guessing in which producers supposedly engage not incorporate the risks of governments exacerbating things?

In his second attempt to formulate ABCT, Mises appears to steer clear from the notion of the APS, despite the fact that in the discussion of production processes undertaken in time and the nature of capital, he may seem to be alluding to similar ideas.

First, Mises appears to second the usefulness of the notion of the period of production during which goods-in-process mature into final consumer goods:

The total expenditure of time required, i.e., working time plus maturing time, may be called the period of production. The period of production is long in some cases and short in other cases. It is sometimes so short that it can be entirely neglected in practice.⁶³

Then, he seems to endorse the description of the economy's production pattern where those goods-in-process pass from one stage to another:

Production is distributed among numerous individual plants, farms, workshops, and enterprises each of which serves only limited purposes. The intermediary products or capital goods, the produced factors of further production, change hands in the course of events; they pass from one plant to another until finally the consumers' goods reach those who use and enjoy them. The social process of production never stops. At each instant numberless processes are in progress some of which are nearer to, some remoter from, the achievement of their special tasks.⁶⁴

Like Hayek, Mises also attempts to even squeeze the durable capital goods like plants and equipment into the notion of maturing inputs:

Neither is it correct to call the capital goods labor and nature stored up. They are rather labor, nature, and time stored up. The difference between production without the aid of capital goods and that assisted by the employment of capital goods consists in time. Capital goods are intermediary stations on the way leading from the very beginning of production to its final goal, the turning out of consumers' goods. He who produces with the aid of capital goods enjoys one great advantage over the man who starts without capital goods; he is nearer in time to

⁶³ Mises, 1963 (1949), p. 479.

⁶⁴ Mises, 1963 (1949), p. 492.

the ultimate goal of his endeavors.⁶⁵

However, while Mises is talking about all the capital goods in the economy as turning into consumer goods, the key thing that is missing from his account that precludes it from being classified as an APS-based one is aggregation. Nowhere in his treatment of capital and production processes does he implicitly or explicitly attempt to reason in terms of the production structure of the economy as a whole and consequently about its elongation, the elongation of the average period of production, etc. And if we consider his approach when he turns to examining what, in his view, happens after credit expansion is initiated, we may see that he attempts to reason in terms of the actual mistaken investment projects.

This focus is already apparent in the masterbuilder analogy:

The whole entrepreneurial class is, as it were, in the position of a masterbuilder whose task it is to erect a building out of a limited supply of building materials. If this man overestimates the quantity of the available supply, he drafts a plan for the execution of which the means at his disposal are not sufficient. He oversizes the groundwork and the foundations and only discovers later in the progress of the construction that he lacks the material needed for the completion of the structure. It is obvious that our masterbuilder's fault was not overinvestment, but an inappropriate employment of the means at his disposal.⁶⁶

It is obvious that this analogy is a lot more appropriate for analyzing individual investment projects than the pattern of production as a whole. This approach also allows separating the investment projects of interest from the inputs that are used in undertaking them and for which they may compete with other productive activities, thus allowing for the crucial source of scarcity the need for which was discussed above.

And when Mises considers the impact of the loan market interest rate artificially reduced by credit expansion, he frames the discussion directly in terms of individual entrepreneurs' decision-making:

A drop in the gross market rate of interest affects the entrepreneur's calculation concerning the chances of the profitability of projects considered. Along with the

⁶⁵ Mises, 1963 (1949), p. 493.

⁶⁶ Mises, 1963 (1949), p. 560.

prices of the material factors of production, wage rates, and the anticipated future prices of the products, interest rates are items that enter into the planning businessman's calculation. The result of this calculation shows the businessman whether or not a definite project will pay. It shows him what investments can be made under the given state of the ratio in the public's valuation of future goods as against present goods. It brings his actions into agreement with this valuation. It prevents him from embarking upon projects the realization of which would be disapproved by the public because of the length of the waiting time they require. It forces him to employ the available stock of capital goods in such a way as to satisfy best the most urgent wants of the consumers.

But now the drop in interest rates falsifies the businessman's calculation. Although the amount of capital goods available did not increase, the calculation employs figures which would be utilizable only if such an increase had taken place. The result of such calculations is therefore misleading. They make some projects appear profitable and realizable which a correct calculation, based on an interest rate not manipulated by credit expansion, would have shown as unrealizable. Entrepreneurs embark upon the execution of such projects. Business activities are stimulated. A boom begins.⁶⁷

However, while Mises' version of ABCT arguably does not suffer from certain problems inherent in the APS scheme, there is one feature that it shares with the APS-based accounts that undermines it. This feature is the reliance on an equilibrium construct. While the particular equilibrium construct Mises relied on differs from Hayek's and Garrison's Walrasian one,⁶⁸ as Mises makes clear, it implies that prices must tend to immediately reflect the changing market conditions:

If the money relation – i.e. the ratio between the demand for and the supply of money for cash holdings – changes, all prices of goods and services are affected. [...] The final state of the rate of originary interest to the establishment of which the system tends after the appearance of changes in the money relation is no

⁶⁷ Mises, 1963 (1949), p. 553.

⁶⁸ In *Human Action*, Mises relies on at least two general equilibrium constructs (the evenly rotating economy (ERE) and the final state of rest). The one that interests us here is that of the final state of rest but its relation to the ERE is that the final state of rest becomes turns into ERE if there are no more external changes to the system but agents within it continue mechanically doing what they were doing.

longer the final state toward which it tended before.⁶⁹

What Mises means here is that at each moment prices are set in markets they start incorporating the changes that have taken place and could incorporate them completely if new changes did not constantly happen. This is a more realistic approach than the Walrasian equilibration that implies that prices immediately and fully incorporate new information but it is still ultimately incompatible with the cluster of erroneously undertaken projects because the prices of the goods for which they compete with other productive activities in this scenario would start incorporating the future impact of these projects early on.

Mises was aware of the problem but claimed that the erroneously started projects will also raise the wage rates and thus the prices of consumer goods, hence maintaining the illusory profitability of the aforementioned projects, despite the increase in prices of the inputs which they divert from the lower stages.

The first problem with this attempted solution is that it implies that the employees involved in the unjustified projects will tend to spend more on the same goods as the final goods the unjustified projects are planned to deliver. This seems to render ABCT applicable only to a very narrow scenario, given the huge diversity of consumer goods available in the modern economy. More importantly, even if we stick to Mises' excessively aggregative mode of reasoning here, his attempt to avoid a paradox where credit expansion almost immediately undermines itself overlooks the fact that the increased demand for consumer goods will raise the prices of inputs even more, thus still almost immediately frustrating the calculations behind the initially illusorily profitable projects.

Hence, Mises' ABCT account appears to be inadequate for explaining how the erroneously initiated investment projects lying at the core of the boom can be undertaken for long periods of time, probably years before their unsustainable competition with some other productive activities is revealed. We will now turn to a more recent non-APS-based attempt to formulate ABCT to see whether it succeeds.

1.4.2 Gimenez-Roche's non-APS-based account of ABCT

⁶⁹ Mises, 1963 (1949), p. 538.

Another attempt to restate ABCT without relying on the APS construct that deserves to be considered here is Giménez Roche's (2016) work. There are two key features that make Giménez-Roche's approach stand out. First, he suggests broadening the range of the potential activities that may be erroneously undertaken due to the credit expansion. He attempts at fleshing out a detailed ontology of entrepreneurial misjudgments and malinvestments, considers how investment projects with different time structure of cash flows may be susceptible to them, which projects banks are more likely to select for financing, and so on. The details of this discussion are, however, beyond the scope of this work.

Secondly, Giménez Roche suggests switching ABCT's emphasis from the interest rate transmission channel of malinvestment to other avenues of malinvestment that may be amplified by the availability of artificially created credit. In particular, he claims that it is implausible that the business cycle is ignited by the injection of such credit with nothing else changing before that. Nor is it likely that the lowering of interest rates that would result from such an injection will cause longer projects in the sense of ABCT to be undertaken immediately.

Rather, in response to the accommodative policies of the central bank, certain firms in good financial standing for one reason or another (for instance out of over-optimism) start not the longer projects but the expansion of the production activities that they are already undertaking. The increased economic activity spills over to their suppliers and further down the line, which improves those firms' financial standing. It is at this point that the artificially created credit enters the picture. Increasing cash flows also boost the stock prices of the affected firms allowing them to attract financial capital not just in the form of bank loans but also new equity contributions. This tends to raise the stock prices even further and allows such firms to borrow more because of improving financial ratios.

However, since neither a freeing-up of resources, nor a change in consumer preferences has taken place, the firms participating in the expansion process start seeing their financial ratios deteriorate because they need to pay more for inputs or are paid lower prices for the goods they produce, or both. Firms can maintain expansion for some more time by extending it to new (for instance, foreign) markets but when this option is exhausted, they finally have to resort to undertaking longer projects in the traditional ABCT sense. Then, the traditional story takes over.

Overall, Giménez Roche's work contains some potentially promising insights such as the recognition of the potential of equity transmission channel and the questions raised by firm heterogeneity and the role of collateral and financial ratios in attracting bank loans. It also contains an impressive ontology of potential malinvestment types that may usher fruitful avenues for the future research. His work may potentially be complementary to the ideas formulated in this volume.⁷⁰

Nonetheless, the question that is most immediately pertinent to this work is whether Giménez Roche provides sufficient explanation of how various malinvestments are made more likely by credit expansion. In this respect it has to be said that Giménez Roche, while avoiding the flaws discussed above inherent in the usage of the APS and equilibrium constructs, does not nonetheless address the key questions that need to be answered with regard to the erroneous projects driven by credit expansion:

- 1) How do investment projects driven by credit expansion that require higher utilization of certain resources than before their launch be undertaken without whatever causes them to appear illusorily more attractive being canceled out by the rising prices of those resources?
- 2) Why do those investment projects later start facing manifest difficulties?

In other words, as will be discussed in more detail in the next chapter, Giménez Roche, like his predecessors with the exception of Mises, overemphasizes the potential financial signalling effects of the credit expansion (even if in a much more sophisticated way) without paying sufficient attention to the core issue of the physical resource scarcity that eventually must negatively affect the erroneously undertaken investment projects.

1.4.3 The credit search-based account of ABCT by Dong, Wang and Wen

The final non-APS-based version of ABCT that merits consideration in this volume is the one outlined and formalized in a recent paper by Dong, Wang and Wen (2016) based on the notion

⁷⁰ It has to be noted, however, that this author owes no intellectual debt to Giménez Roche (2016) since the gist of the theoretical perspective developed herein already appeared in Gorbatenko (2014).

of search and matching costs in credit markets. Their approach does not appear to be based on the APS construct because it does not invoke changes in the intertemporal pattern of investment but rather an increase in investment in general as a result of the credit expansion. It is worth analyzing separately because it is based on a neoclassical general equilibrium model. If this approach were to succeed, it would undermine the claim made in the introduction that an alternative to the neoclassical methodology may be necessary to throw light on the business cycle phenomenon and that ABCT could be such an alternative.

The core idea underlying Dong, Wang and Wen's treatment is that in the real economy both matching the would-be depositors to banks that would accept their deposits and would-be corporate borrowers to the banks that would lend funds for investment projects are costly, hence, not all the savings are deposited with the banks, and not all the deposited savings are transformed into loans. Therefore, some investment opportunities that businesses could have embarked upon are not taken advantage of.

However, if the central bank creates the expectation that the supply of credit is going to increase, firms are incentivized to expend more effort to search for loans for their investment projects. As their investment spending rises, this spills over into the revenues of their employees who can then save more, which, in its turn, results in more deposits being available for lending. The increased supply of credit leads to the reduction in the loan market rate and thus decreases the cost of investment. Nonetheless, the thereby created investment boom cannot continue without limit since the firms' productive technologies are subject to decreasing returns on investment at some point. This marks the reversal of the investment expansion.

The first issue with this approach to ABCT is that it militates against the core intuition behind the latter that the boom phase of the business cycle does not have to involve general overinvestment. Secondly, it does not actually have a room for genuinely artificial credit expansion as the whole increase in the supply of credit arises from the savings that would otherwise have remained idle. This raises the question why entrepreneurial firms need the signal from the central bank in order to start inducing a higher supply of credit via the proposed mechanism.

Adding to this, Dong, Wang and Wen overlook the fact that in the real economy, banks do not fund their loans with deposits on the 100%-reserve basis. Rather, fractional-reserve lending is

the norm. Hence, in order to fund more investment projects, banks do not have to attract more savings as deposits but may just decrease the reserve ratio subject to the regulatory restrictions that they face.

Perhaps, most importantly, like Giménez Roche, Dong, Wang and Wen appear to disregard input prices and the competition for inputs among various economic activities. If this were not the case, it would pose a problem for their explanation at the very early stage where firms expand investment after receiving more loans thanks to boosting their loan search efforts. In the presence of input scarcity, this would lead to higher input prices, which would tend to counteract the credit availability effect.

1.5 Chapter summary and implications

In the preceding sections of this chapter, the historical background and the major previously proposed versions of ABCT were analyzed in order to establish whether the theory requires another restatement. The initial impression may be that, given how many versions of the theory one may find in various sources, enough may have been stated on it and only empirical work on it is needed in the future.

However, as was demonstrated above, despite the insights they contain, neither the versions of ABCT relying on the APS construct nor those that do not provide a satisfactory body of theory to throw light upon the business cycle phenomenon. Among multiple problems with the APS-based versions, the most important one is that they do not accommodate the most important way malinvestments may happen, namely, through projects involving the creation or expansion of plants and equipment. At the same time, the processes that can be described in terms similar to APS, even though the aggregate aspect of it needs to be discarded, do not appear to result in reallocating resources from consumption at some point during the boom, and thus, do not seem to be fitting candidates for explanation with the help of ABCT. Non-APS-based ABCT accounts avoid some of the issues that trouble the APS-based ones but still fail to either explain or consider the key question how genuine mistakes involved in the credit-expansion-driven long projects are

not discovered early on when they are launched. In the following chapter, an attempt will be made to formulate a version of ABCT that would steer clear from the aforementioned weaknesses.

2. A Restatement of ABCT

2.1 Chapter introduction

This chapter is the core part of this work as it will attempt a restatement of ABCT that will strive to avoid the problems that were identified with the preceding versions of the theory. The formulation in this chapter will not be formalized, meaning that it will not contain a mathematical model. The next chapter that contains a computer model does not provide a complete formalization, either, because it illustrates the core logic without accommodating all the possible ways the pattern envisaged in by this work's version of ABCT may play out.

In line with the preceding chapter, the two key features of the theory developed in this chapter are as follows:

- 1) it reasons about the business cycle pattern directly in terms of the actual investment projects initiated because of the credit expansion, bank loans allocated to them through which the credit expansion manifests itself, the intermediate goods these projects divert, and the particular projects that are in a certain sense defined below closer to delivering final consumer goods. It thus avoids the use of the APS construct as well as other problematic constructs such as the natural rate of interest and the gross market rate of interest;
- 2) it also avoids the use of equilibrium constructs thus allowing for the genuine errors that, as we have seen, are needed to make sense of the business cycle pattern.

2.2. Basic terms and assumptions

In order to start giving an explanation for a certain pattern (like the business cycle), it is paramount to start with defining the terms, or the major elements that figure in the pattern.⁷¹ The most important of those elements is the cluster of investment projects that are undertaken because

⁷¹ It is essential to note that, philosophically, this work is based on the idea that it is impossible to give a definition of a concept from which all the characteristics of its instances in all possible situations can be deduced. Rather, the idea is that the definition should be sufficient for singling the instances of the concept in the real-world examples. For a more detailed outline of this idea, see, for example, Rasmussen (1983).

of the credit expansion and face difficulties at some point during the boom which were variously referred to above as the “credit-expansion-driven long projects”, “ABCT-envisaged projects”, etc. and which are hereinafter referred to as the “excessively long projects.” A more precise definition of them will be given shortly because, as it will become clear, they may not be meaningfully defined except with the reference to certain other projects with which they compete for certain inputs.

One feature of the troubled projects in question is obvious from the start. They either need to fail or be abandoned or frozen or, at a minimum, they need to cause sufficient problems to make their originators either abandon, freeze or scale them down or cut spending on other activities. Otherwise, it would be unclear in which sense their duration is excessive.

It is important to note from the start that among the elements of ABCT, the notion of “excessively long projects” is the only one contingent on a certain outcome that takes place with a substantial lag from the beginning of the cycle pattern.⁷² Hence, it is necessary to use another term for the projects driven by the credit expansion before they start facing difficulties (if they ever do), namely, “credit-expansion-driven long projects.”⁷³ Such projects may either become excessively long when they start facing difficulties in the way envisaged by ABCT – and thus become the referents of ABCT in an actual historical episode – or be completed, despite being enabled by loose monetary policies.

Here, the question may be asked whether, even if the credit-expansion-driven long projects are completed without facing difficulties in some way, they may have a major negative impact on the economy. For instance, as will be shown below, they will bid away certain inputs from projects facilitating production of certain consumer goods different from those whose production is facilitated by the credit-expansion-driven long projects. However, the question of their impact, while, admittedly, interesting is beyond the scope of this work but may be subject to future research.

⁷² To the knowledge of this author, this work is the first one in the ABCT tradition to explicitly acknowledge the possibility that credit-expansion-driven projects are actually not bound to fail and may merely result in a change in the pattern of consumer good production at some stage.

⁷³ The word “long” is added to the term because, as will be discussed below, credit expansion does not have to only facilitate investment projects that may become excessively long. It may just result in the subsidization of activities that are not longer than the activities from which they bid away resources.

An essential observation with regard to the excessively long projects is that they start facing difficulties before they start delivering final consumer goods to the market or contributing to such delivery (if the projects are related to intermediate activities) or at least become fully operational in this sense. As an example of the latter case, a hotel and casino complex like CityCenter may have a part of its scheduled room space completed earlier than the other parts.

This observation suggests three major possible types of economic causes of their failure (apart from some external physical impediment like changes in government regulation or natural disasters):

- 1) Their originators realize that they were mistaken in their assessment of the future demand for the relevant consumer goods.
- 2) Certain innovations make it more profitable to use the resources involved in the relevant projects elsewhere.
- 3) There is an unexpected increase in costs of the projects (cost overrun).

The first possibility seems to be precluded by the fact that we are dealing with a cluster of investment projects. If we take into account the coordinative properties of the market process, they seem to cast doubt on the possibility of systematic spontaneous entrepreneurial mistakes of the kinds that are necessary.

The second alternative does not square well with the fact that the failure of the excessively long investment projects marks the beginning of the bust stage of the business cycle. Innovations should tend to result in economic growth, not in decline. Thus, we are left with the third alternative, i.e. that the unsustainability of the excessively long projects results from an unforeseen increase in the costs of their implementation. We will be assuming here that the costs of investment projects are well approximated by the expenditures on labor and intermediate goods necessary to complete them.

It is clear from the intuitions underlying ABCT that the unexpected growth of costs that hits the excessively long projects is of an endogenous nature. Otherwise, the whole idea of the business cycle would have been unfounded. In other words, there must be some process internal to the market which aggravates the always present scarcity of intermediate goods which somehow

arises from the mistaken decisions of the economic agents competing with each other for those goods.

The process internal to the market is competition. Thus, the excessively long projects must compete with some other projects in an unsustainable way for certain resources (hereinafter, the “contested goods”). Unlike the former, the latter projects (hereinafter, the “closer-to-consumption projects”) must result (directly or indirectly) in the production of final consumer goods at some point during the boom stage that is not matched (in terms of market value) by the excessively long projects. This has to be the case because, otherwise, there would be no clear role for consumer preferences in bringing about the reversion of the erroneously-created pattern of resource allocation, as discussed below.⁷⁴

It should be noted here, however, that some of the excessively long projects may initially involve a relatively lengthy phase where instead of heavily using inputs or even borrowing loans, their originators may be engaged in preliminary activities such as research and development, exploring the locations suitable for construction, obtaining regulatory permits required for the projects to proceed and so on. The particular way in which these projects (hereinafter, “excessively long projects abandoned in the preliminary stage”) may have a negative impact on the economy will be discussed in the following section.

The closer-to-consumption projects do not necessarily have to take less time to facilitate the delivery of the final consumer goods than the excessively long projects in the absolute sense. Rather, at the moment at which the latter projects are started, the former must be closer to the contribution to the production of final consumer goods. This allows us to sidestep the pitfalls caused by attempting to arrange productive activities into a rigid temporal order that were discussed at some length in the preceding chapter.

The crucial difficulty here is to pin down where exactly the excessively long projects⁷⁵ and the closer-to-consumption projects are relative to facilitating the production of final consumer goods during the boom phase. The simplest solution would be to say that the excessively long

⁷⁴ Those credit-expansion-driven long projects that do not face sufficient difficulty to qualify as excessively long also bid away the contested goods from the closer-to-consumption projects but in a way that does not cause the same consequences.

⁷⁵ This also applies without modification to credit-expansion-driven long projects in general.

projects do not result in the facilitating the delivery of final consumer goods during the boom phase at all while the closer-to-consumption projects do it throughout it or at least start doing it a certain point. However, this would make the theory applicable to a range of situations that is unnecessarily narrow.

In order to arrive at the solution we must recall that the underlying intuition is that the excessively long projects (and credit-expansion-driven long projects) at some point during the boom phase temporarily divert the contested goods from the production of certain consumer goods their consumers expect to be able to purchase at that point (hereinafter, the “affected consumer goods”). As discussed in some more detail below, the relevant consumers (hereinafter, the “affected consumers”) act to revert this, as, after a while, the contested good producers discover that the affected consumers are actually prepared to pay more for the affected consumer goods. This means that in order for the pattern envisaged here to play out it is not absolutely necessary that the excessively long projects do not facilitate the delivery of the final consumer goods during the boom phase at all. Rather, they should not be able to do it sufficiently to be able to compensate for the increase in the contested good prices.

The words “facilitate the delivery” are used deliberately throughout this chapter because neither the excessively long projects (and by extension, credit-expansion-driven long projects), nor the closer-to-consumption projects have to directly produce finished consumer goods at some point. For instance, a closer-to-consumption project may involve the production of certain automobile components used in the final assembly, while an excessively long project may consist in constructing a container terminal.

It remains to explain the difference between credit-expansion-driven long projects in general and excessively long projects in particular. The latter should be viewed as a subset of the former that faces sufficient financial difficulty as a result of the price increase caused by the increased competition for the contested goods. The latter means that their originators should be forced to change their behavior in a way that is reflected in temporary negative economic consequences. There are at least two conceivable ways this may happen. First, the changed conditions may make the excessively long projects’ originators scale them down, put their implementation on hold or completely abandon them. Alternatively, the originators of the excessively long projects may compensate the cost increases by cutting their spending on other

activities. At the same time, some credit-expansion-driven long projects may not be sufficiently affected by the contested good price increase. There may be multiple reasons for this but the most straightforward one is that their margins of error (as discussed in some more detail below) may turn out to be sufficient for absorbing it.

Hence, we have arrived at the interconnected definitions⁷⁶ of the three concepts that are crucial for the ABCT restatement pursued here:

- 1) Credit-expansion-driven long projects are investment projects that:⁷⁷
 - a) Actually involve substantial use of scarce inputs during the boom and
 - are launched after the credit expansion using the credit it generated and would not have been launched without it;
 - compete with the closer-to-consumption projects for the contested goods;
 - do not result in facilitating the delivery of final consumer goods before the bust phase of the business cycle or at least in facilitating their delivery to the extent sufficient for compensating for the contested good price increase;
 - will not fail if they are completed in the sense that they will not result in the delivery of final consumer goods; or
 - b) the excessively long projects abandoned at the preliminary stage.
- 2) Excessively long projects are the credit-expansion-driven long projects that face financial difficulty before being completed because of their revealed actual or imminent competition with the closer-to-consumption projects for the contested goods. Such financial difficulty should be sufficient to either make their originators scale down, freeze or abandon them or reduce spending on other activities.
- 3) Closer-to-consumption projects are projects that facilitate the delivery of final consumer goods earlier than the credit-expansion-driven long projects or create substantially larger total value thereby than the credit-expansion-driven long projects during the boom phase.

⁷⁶ The importance of these observation is addressed more directly in chapter 5 with regard to the empirical application of ABCT to concrete historical boom-and-bust episodes.

⁷⁷ It must be noted that the definitions provided here are not exhaustive, since this work is based on the idea that exhaustive definitions of concepts cannot be given. This issue will be addressed in somewhat more detail in chapter 5.

- 4) The contested goods are the inputs for which the credit-expansion-driven long projects and the closer-to-consumption projects compete among themselves to a substantial degree. The latter means that when the competition becomes manifest it should hamper either the credit-expansion-driven long projects or the closer-to-consumption projects.
- 5) The affected consumer goods are the goods whose production is effected or facilitated by the closer-to-consumption projects and whose production is initially reduced because of the increased competition for the contested goods that are an important input/important inputs in their production.
- 6) Affected consumers are the consumers whose consumption plans are initially frustrated by the reduction in the supply of the affected consumer goods but who later act to reverse it in the manner described in more detail below.

Now that the necessary definitions have been given, we may proceed to the next logical step, *i.e.* the description of the general pattern using the relevant terms.

2.3. What happens during a business cycle episode

An additional building block that is needed for the description of what happens during the credit expansion-driven boom-and-bust episodes derives from the character of business planning undertaken in time. In their activities, the originators of the excessively long and the closer-to-consumption projects cannot just base their planning on wild guesses about what goods the consumers will prefer to buy. They must ground their plans in the relevant experience from the immediately preceding period or periods (the “reference period(s)”).

There is also a third class of entrepreneurs which have been ignored in the previous versions of ABCT whose decisions are, however, indispensable for producing the boom pattern. These are the suppliers of the contested goods. They also must ground their planning for the boom period on reference period(s). We will discuss their role in more detail in the next section. Finally, the same kind of reasoning applies *mutatis mutandis* to the banks that allocate the excess credit whose creation is enabled by the central bank.

In connection with business planning, it is essential to consider the issue of invariants compared to the reference period(s). It is clear that if a lot of changes not related to the credit expansion and excessively long projects happen relative to the period(s) that the various agents involved use for reference, this may make reasoning about the effects of the credit expansion and the excessively long project cluster difficult. On the other hand, if the theory developed here is to illuminate actual historical episodes affecting complex, dynamic economies, it is implausible to assume that nothing else changes during the boom phase except for the credit expansion and the effects it produces. In other words, it is not possible to get away with a simple *ceteris paribus* clause here.

However, it is possible to attempt to list the invariants that are necessary in a narrow and broader sense. The narrow sense here denotes the need for a cluster of credit-expansion-driven long projects to develop and then face financial difficulties to become excessively long. In the broader sense, the cluster of excessively long projects has to be able to spark an economic downturn.

Let us start with the invariants in the narrow sense, first.⁷⁸ Clearly, to the extent that the closer-to-consumption projects are just a continuation of the production processes of the reference period(s), one of the most important invariants is that the affected consumers should not change their preferences with regard to the affected goods in the sense of having substantially reduced demand for them compared to the reference period(s). This may happen through, for instance, the appearance of substitutes of the affected goods that do not require the use of the contested goods in production completely or at least to the same extent as before. Or consumer goods that are not substitutes may be created that nonetheless may reduce the demand for the would-be affected goods.⁷⁹ Another way this invariant may not hold is that economic decline may be caused by a mechanism different to the one envisaged here that makes the would-be affected consumers reduce their consumption of the would-be affected goods before they could act to reverse the reduction in their production.

⁷⁸ It has to be noted that it is beyond the scope of the work to attempt to list all the possible variations of the broadly formulated invariants. Nor is it necessary given the conceptual approach discussed above that this work adheres to.

⁷⁹ In a certain sense, contrary to a widespread misconception a sophisticated understanding of competition implies that most good and service producers in the economy are in competition with most others.

The situation is a bit trickier, though, with respect to the closer-to-consumption projects that are investment projects that merely happen to start to contribute to the production of final consumer goods to a larger extent than the excessively long projects during the boom phase. Clearly, consumers may not have revealed their preferences for such goods during the reference period(s). However, let us assume here that in the absence of major unexpected external changes, businesses tend to predict consumer preferences relatively correctly. Then, the invariant here may require that no major external changes happen that render the hypotheses about consumer preferences underlying the closer-to-consumption projects invalid.

Secondly, there should not be sufficient innovation or other factors (like unexpected discoveries of raw material deposits) reducing the cost of the excessively long projects making them avoid difficulties, even in the face of the unexpected increase in costs envisaged here. The innovations in question may take various forms, including less expensive production processes of the contested goods, as well the discovery of sufficiently cheaper ways of producing the would-be affected goods.

In addition to the above, the excessively long projects or the closer-to-consumption projects should not face external impediments to their implementation, such as regulatory crackdowns on certain activities, wars, natural disasters. Finally, there should be no abrupt reversals in the credit market conditions that gave rise to the excessively long projects. A potential example of this is the central bank deciding before the unsustainable competition for the contested goods is revealed that it should substantially tighten the monetary policy for some reason unrelated to the pattern envisaged here. If the terms of the loans granted to the excessively long projects' originators allow for adjustable interest rates or for the banks' canceling or modifying the terms of further withdrawals of credit lines/revolving loans, this may undermine the apparent credit-induced increased attractiveness of those projects.

In order for the cluster of excessively long projects to be capable of causing an economic downturn⁸⁰, other invariants need to be added. To start with, the phase where the excessively long projects start facing difficulty should not coincide with continued economic growth in unrelated sectors of the economy that may cancel out whatever negative effects the revelation of the

⁸⁰ As was mentioned earlier, this work concerns itself only with the initial downturn without attempting to explain what is usually called the "the secondary effects."

erroneous nature of the excessively long projects creates. These effects can be similarly potentially compensated for by unrelated government policies aimed at boosting economic activity, such as, for instance, deregulation of overregulated sectors or supply-side tax cuts. Another plausible countervailing influence may come from the relatively open nature of most modern economies. For instance, the stage where the excessively long projects get into trouble may coincide with a major international trade liberalization.

The preparatory steps which were made above allow us to zoom in on the important but vague intuition underlying ABCT in a straightforward way. The idea is that during the boom stage of the business cycle the pattern of production deviates in some sense from the pattern of consumer demands. This deviation may now be said to consist of a cluster of excessively long investment projects temporarily diverting part of the contested goods from the closer-to-consumption projects not in accordance with affected consumers' preferences. Credit expansion by central banks will tend to create this pattern subject to the invariants listed above.

To clarify this general statement, at some point during the boom stage of the cycle, the originators of the closer-to-consumption projects discover that they are unable to supply as much of the affected consumer goods or the inputs used in the production of the affected consumer goods as they were planning to because the prices for the contested goods used in their production have become too high because of the added demand from the excessively long projects.

At the same time, the preferences of the relevant consumers with regard to the affected consumer goods have not changed compared to the reference period(s). In certain conditions, consumers may act to reverse the allocation of the contested goods to the excessively long projects. These conditions are as follows:

- 1) The affected consumers' reserve prices for the affected consumer goods are higher than the pre-reallocation prices, are sufficient to allow the originators of the closer-to-consumption projects to bid the closer but the originators of the closer-to-consumption projects are not aware of this fact.
- 2) It takes time for this discrepancy to be discovered such that the excessively long projects have time to misallocate significant resources.

The reversal of the reallocation happens by means of price signals. The originators of the closer-to-consumption projects observe that they are able to demand higher prices for the consumer goods that they produce than in the reference period(s), and they know that they are supplying fewer of them in the current period. To the extent that it is still profitable for them to increase production of the affected consumer goods, despite the need to compete for the contested goods with the excessively long projects, they will tend to grasp such a profit opportunity. This increased competition for the contested goods will tend to drive up their prices.

But how could this turn of events be damaging for the excessively long projects? The only possible answer is that they must be relatively tailored to the prices of the contested goods at which their originators are initially able to acquire them. They must not necessarily become unsustainable with any increase in the prices of the contested goods which go into their calculation. It is sufficient that the potential increase in their prices for which the calculations of the projects provide (margin of error) is lower than the actual increase through the process described above.

This condition for the unsustainability of the excessively long investment projects is quite plausible. After all, at the stage of planning the projects, the entrepreneurs who consider undertaking them must make use of the then current prices of the contested goods. Based on the reference period(s) they will likely make provisions for those prices fluctuating within a certain range. However, this safety range may well turn out to be not sufficient upward to absorb the aforementioned increase in the prices of the contested goods.

There is an additional mechanism through which some of the excessively long projects may start facing difficulties even before the affected consumers start boosting the contested good prices. If the cluster of excessively long projects is significant enough and a large part of those projects happen to have similar schedule, then if they converge on a certain stage that involves an intensification in their demand for a certain contested good or goods, the resulting price increase may put some excessively long projects in trouble on its own. Such scenario is possible because the originators of individual excessively long projects are unlikely to be aware of the details of similar projects that are about to be launched at roughly the same time, and are highly unlikely to consider the combined impact they are going to have on the input prices. A potential real-world example of such a pattern is discussed in chapter 5.

Finally, as was mentioned in the preceding section, there is a separate category of the excessively long projects, namely the excessively long projects abandoned at the preliminary stage, that is affected by the discovery of the unsustainable competition for the contested goods differently from the other excessively long projects. The mechanism in question, however, requires the presence of a substantial cluster of the ordinary excessively long projects.

More precisely, it may become clear for the originators of certain excessively long projects that are still at the preliminary stage that the contested good price increase renders them less attractive than needed for undertaking them. For the sake of tractability, however, this work does not consider this sort of projects in much depth given that a special combination of circumstances may be needed to produce their cluster.

2.4. How the various errors involved are made more probable by credit expansion

In the preceding sections, we dealt with the way the business cycle needs to be described. Now, we need to explain how the genuine entrepreneurial errors that are required in order for the pattern described above to play out are made substantially more probable by credit expansion. The words “made substantially more probable” are used deliberately because the abandonment of the equilibrium framework necessarily leads to the abandonment of an apodictically certain link between the credit expansion and the cluster of unsustainable investment projects. For instance, instead of being channeled into long-term investment projects, the excess credit may find its way into the production of durable consumer goods like housing. Alternatively, the error margins of the credit-expansion-driven long projects may be just high enough to withstand the increase in the prices of the contested goods.

However, before we start explaining how the malinvestment pattern may plausibly happen because of credit expansion, we must ask another question. How do markets achieve the relative coordination between the inter-temporal pattern of production and the inter-temporal pattern of consumer preferences in the case of a somewhat similar situation not involving credit expansion? We are talking here about a scenario with an increase in the supply of voluntary savings that are made available to the banking system. Echoing the famous comment by Hayek on Keynes’s theory

of macroeconomic instability, it is essential to explain how the coordination mechanism works in the normal case in order to understand how it might fail in the case of credit expansion.

In other words, the question is why additional monetary savings made by consumers will tend to be channeled into the right projects and why credit expansion will tend to cause an inter-temporal disconnection between investment projects and consumer preferences. To answer these questions, we need to consider the elementary mechanics of a bank investment loan.

In order to draw down an investment loan, the entrepreneur must believe that the project that will be financed with this loan will provide a return which will exceed the amount of the money she will owe to the bank by at least a certain amount. This implies that the decision to draw down a loan will only be made if the entrepreneur expects a certain minimum level of profitability of the relevant project.

The availability of the additional money for the banks to lend as a result of an increase of savings does not in itself change the expected profitability of any investment project. What changes the expected profitability of some projects is the fact that the corollary decrease in the demand for consumer goods lowers the prices of some intermediate goods that can be used in those projects. To the extent that entrepreneurs recognize the increased expected profitability of some projects, this circumstance tends to cause the demand for investment credit on their part to rise and to allow the banks to loan out the additional money they received from the savers.

But why will the additional amount of money arising from the savers' making savings through the banks tend to be at least partially allocated to the projects which have become more profitable in the way described above? The answer has to do with our description of business planning in time in section 2.3. Banks also have to ground their lending plans in the reference period(s). If there is no significant change in the boom period in the other projects that they would finance compared to the reference periods, banks will not tend to allocate the additional money to them if there are investment projects which are now more profitable even without any decrease in the interest rates. Thus, the additional money will tend to be allocated to the projects which have become more profitable as a result of the increase in voluntary saving without any connection to interest rates.

It is important to note here that the average interest rate in the loan market may not even fall as a result, contrary to what is usually claimed. This is not a violation of the basic supply and demand reasoning because the fact that some projects became profitable compared to the reference period(s) results in an increased supply of loanable funds being met by an increased demand.

Thus, the key inter-temporal coordinative role is played by the prices of the relevant intermediate goods. As was discussed above, in the previous accounts of ABCT, their role was not sufficiently recognized and excessive attention was paid to the aggregates of interest rates.

Now that we have looked into the way the coordination works in the case of the additional credit arising from an increase in savings, we can start addressing the important question why a credit expansion may plausibly result in the discoordination described by ABCT. What changes in the credit expansion scenario is that there is no decrease in the prices of intermediary goods because the consumers have not reduced their consumption, a key pillar of the coordinative mechanism is missing from the start, which opens the way for the excess credit to be allocated either to the excessively long projects or to some other activities to which credit would not have been allocated in the absence of accommodative monetary policies.

This, in turn, leads to the question why at least some of the newly created loans are likely to be allocated to the excessively long investment projects in the case of a substantial credit expansion, given that their underlying prospects have not improved. The most plausible reason for this is that banks probably face lower transaction costs when they need to negotiate and supervise a single loan of a longer duration as opposed to two or more loans of shorter duration. In the latter case, they have to renegotiate the terms of the loan(s), reassess the characteristics of the project and its originator, etc. This appears to be a much more straightforward explanation than the invocation of rather convoluted constructs like roundaboutness that was discussed in chapter 1.

Another question that arises with regard to the explanation of the errors that various entrepreneurs are supposed to make is that, in principle, entrepreneurs might be aware of ABCT and might thus avoid errors by not borrowing the money that arises from credit expansion. The solution to the problem lies in realizing that for various reasons discussed above there is no automatic connection between credit expansion and the undertaking of excessively long projects. First, the originators of the excessively long projects will usually not be able to ascertain that the

projects of their type previously would not have been financed by banks at the rate that the banks currently proposed to them, unless they actually tried to obtain credit financing for them in the past and failed. Secondly, even if they did the latter, it may be hard for them to determine whether banks refused to lend them money in the past because their expected future profitability was too low for the banks back then or because of some other features of their projects such as the risks peculiar to them. In addition to this, they may believe that the margins of error they use in planning their projects are likely to be sufficient to cover the potential increase in costs and there may be other potential reasons. Ultimately, this discussion is related to the idea that the connection between credit expansion and the emergence of a cluster of excessively long projects is not apodictic.

The final question which remains to be answered here is why the suppliers of the contested goods who must initially sell them to the entrepreneurs undertaking the excessively long projects at prices that are too low, i.e. do not reflect the changed structure of demands for these goods compared to the reference period(s), may make this error. Here, although the sellers of the contested goods might be able to realize that the demand for them in the current period has increased compared to the reference period(s), in certain plausible conditions it may be difficult for them to do so. The most obvious potential reason for this the excessively long projects may initially not use the contested goods at all or use them to the extent that the increased prices of them caused by the added demand from the excessively long projects are covered by the latter's margins of error. As discussed in the following section, certain kinds of innovations that reduce the cost of production of the contested goods may also contribute to the contested good producers' inability to grasp the full extent of the increase in the demand for them during the boom period.

It may also be questioned how strong the incentives for the contested good producers may be to make sure that the contested good prices reflect the changed demand for the contested goods over the boom period as early as possible. As will be mentioned in section 2.6, the contested good producers may be negatively affected if, once they have discovered the increased competition for their product, they attempt to accommodate it at a cost that is unpalatable for the credit-expansion-driven excessively long projects or the closer-to-consumption projects. However, it is implausible that this will motivate many contested good producers to avoid the need for accommodating the

increased demand later on. This would essentially assume their familiarity or prior discovery of the theory developed here.

To wrap up this section, it appears that the various mistakes that need to be made in order for a round of credit expansion to produce the pattern envisaged by ABCT are plausible even if not inevitable, which, in addition to the definitions of the terms and the description of the cycle using them, completes the core of the business cycle theory. We may now proceed to add some real-world-grounded complexity to it, starting with the reality of innovation-driven economic growth.

2.5 ABCT and economic growth (innovation)

In the modern economies, economic booms that precede busts usually take place in the presence of extensive, persistent innovation. Moreover, sometimes the sectors that are affected by booms are on the cutting edge of innovation, as evidenced by the U.S. “dot-com” boom of the 1990s. The neoclassical approach tends to treat booms and busts and economic growth separately, which Garrison (2001) aptly noted and proposed to rectify.

The previous accounts of ABCT similarly tended to assume scenarios without innovation. Even Garrison’s proposed framework for the capital-using economy distinguishes the scenario with normal economic growth from the scenario with a boom and bust. There is no way in this framework to accommodate a scenario in which both of those phenomena are present to a degree.

Moreover, in the past, the presence of innovation-driven growth contemporaneous with the economic booms followed by busts led economists like Krugman to reject the explanations of economic crises that, like ABCT, posit that crises are at least in part caused by the mistakes committed by entrepreneurs preceding them. For Krugman, this could not be squared with the fact that instead of investment booms diverting resources from consumption, the latter continued to grow until the very beginning of the crisis.

It was mentioned in section 2.2 that certain kinds of innovation need to be precluded in order for the pattern envisaged by ABCT to be realizable. However, this does not mean that the

ABCT account developed here is incompatible with any innovation that may happen simultaneously with the boom phase.

To start with, in section 2.2, a distinction was made between the invariants in the narrow sense and the invariants in the broader sense. It is possible that certain innovation that is not directly related to the pattern described by ABCT (for instance, innovation that concerns economic activities that are not related to the use or production of the contested goods) may partly or fully counteract whatever negative effect the cluster of the excessively long projects has, thus ensuring that the latter does not result in an economic downturn or results in one that is smaller than it otherwise would be. Thus, this sort of innovation does not preclude the core pattern envisaged by ABCT from playing out.

In addition to this, as will be illustrated by means of an agent-based computer model in the following chapter, innovation may in some cases throw light on how some of the errors predicted by ABCT may take place. For instance, the excessively long projects may increase the demand for the contested goods shortly after their initiation but this may not immediately result in sufficiently large contested good price increases if the increased demand is offset by innovations that reduce the cost of production of the contested goods. Then, at some point, if the additional demand from the excessively long projects becomes important enough it may overcome the effects of innovation and lead to the price increase that puts the excessively long projects into trouble that is envisaged by ABCT.

2.6 Potential indirect negative effects of ABCT-described malinvestments and their interaction with other crisis patterns

Another element of complexity that modern economic realities bring to the picture is that the pattern analyzed in this work may have indirect negative effects on the economy or interact with other economic processes that are not directly related to it, in particular, other economic disturbances that may or may not be caused by the same credit expansion that drives the ABCT-envisaged pattern.

To start with, if we recall the case of the CityCenter project discussed in the Preamble and bear in mind that a business undertaking an excessively long project that is facing financial difficulties may, instead of pulling the plug from under that project, try to salvage it by slashing spending on other activities, including other lines of investment or the salaries of its personnel, etc. This means that the economic damage from the cluster of excessively long projects may largely not be directly related to those projects.

What is more, a special case of negative effects may arise from the category of the excessively long projects abandoned at the preliminary stage that was briefly discussed in sections 2.2 and 2.3. Namely, such projects may, because of the preparatory activities they misallocated, result in a shortage of projects at a sufficiently advanced stage to mitigate the negative effect of the excessively long projects that misallocated capital and labor or of other distortions that may be caused by credit expansion.

This ramification becomes especially prominent if we take into account that expansionary monetary policy may not just lead to excessively long projects being undertaken but may also result in a more conventional subsidization mechanism that may unfold relatively simultaneously with the excessively long project cluster. Alternatively, even if the bulk of the excess credit created through monetary expansion is allocated to the excessively long projects, the government may also try to artificially stimulate the economy via direct public investment into various projects. If many businesses have been undertaking excessively long projects at the same time, there may be a shortage of immediately usable entrepreneurial ideas and innovations in order to reallocate the resources misused because of the more direct subsidy mechanism.

This mechanism can be envisaged perhaps the most clearly if we assume that the more directly subsidized sector involves the production of durable consumer goods or their equivalents that require an expense from consumers that is substantial at the time in question. The goods in question may include housing, automobiles, university education, etc., but their composition may change over relatively long periods. At some point, modern appliances like refrigerators, when they were first mass-marketed, were rather expensive for an average family and required loans to purchase them but nowadays, this is less and less the case, at least in the developed world. It also needs to be taken into account that in many cases the relevant durable consumer goods are not purchased completely on credit. Hence, if the flow of subsidy stops or the relevant market is

subsidized into satiation, consumers may start looking elsewhere to spend the money they would otherwise spend alongside the durable consumer credit. However, there may be a comparative lack of goods to propose to them because the businesses that could have done the necessary preparatory work have engaged in the excessively long projects. This may result in consumers' hoarding money, which may then be misinterpreted in the modern Keynesian/monetarist vein as an increase in demand for money balances as such.

In addition to the indirect negative effects stemming from excessively long projects themselves, their undertaking may lead to additional errors down the line. In particular, if the producers of the contested goods, having realized that the demand for their products for the relevant period is going to be higher than they had expected, attempt to accommodate it by investing into increases in production, they will still have to charge higher prices for their products because they bear additional costs. However, as we established, these increased prices may be unacceptable for the originators of the excessively long projects. Thus, at the end of the day, it is not just the originators of the excessively lengthy investment projects who may make malinvestments but also the producers of the contested goods. It is even possible that errors can be made further down the chain by the suppliers of the producers of the contested goods and even their suppliers, but a detailed discussion of these issues is beyond the scope of this paper.

Finally, the effects created by excessively long projects can interact with other economic phenomena that may either amplify them or be amplified by them. While it is impossible to list all such possible interactions, perhaps the most important one may arise from the fact that, as was already mentioned, credit expansion may be channeled not just into excessively long projects but into subsidizing other activities financed at least partially on credit, like, for example, the production of durable consumer goods (housing, automobiles, expensive consumer electronics) that can be bought on credit. If the subsidized activities in question start facing problems while the excessively long projects are still under completion, this may worsen the situation the latter face, by, for instance, lowering the expected demand for the consumer goods to the production of which they are ultimately supposed to contribute. For instance, if the excessively long projects involve the construction of hotels, an economic crisis caused by a bust of a subsidized durable consumption boom may reduce demand for accommodation and hence, the expected profitability of hotels.

In addition, if lending to the excessively long projects is disproportionately concentrated among certain banks, if the originators of many excessively long projects are unable to repay the relevant loans, this may cause the deterioration of the over-exposed banks' balance sheets, and may force them to increase the capital-to-asset ratios by reducing granting of new loans or even to go into bankruptcy. Since it may not be easy for other banks to rapidly compensate for the resulting credit reduction, a credit crunch may occur as a result.

Other detrimental interactions may be identified on a case-by-case basis. As an example of the U.S. auto industry given in chapter 5 demonstrates, if excessively long projects under completion bid away an important contested good from the production of consumer goods the demand for which is falling as a result of an economic crisis caused by separate developments, this may prevent the relevant producers from reducing prices sufficiently to increase sales and minimize the damage caused by the downturn.

At the same time, excessively long projects may be influenced by other economic developments both within the respective national economies and outside of them. For instance, unexpectedly increased demand for some resources used in excessively long projects may make them more vulnerable to the contested good price increases. The relevant resources may, however, not qualify as contested goods since they may not be diverted from closer-to-consumption projects, as their overall production may be increasing. Potential examples of this are discussed in chapter 5 dealing with the U.S. Great Recession.

2.7 Why the theory cannot be formalized by means of a mathematical model

An obvious objection that can be made against the theory sketched out in this chapter is that it should be formalized by means of a mathematical model. In this section, it will be argued that this is not possible, at least using approaches based on the use of an equilibrium construct. Perhaps, future research may demonstrate that some other tool of mathematical modeling can be applied here but this subject is beyond the scope of this work.

As was mentioned above the theory formulated in this chapter attempts to illuminate the business cycle phenomenon in terms of a cluster of specific, excessively long projects that are undertaken based on mistaken forecasts of future prices of the contested goods. If equilibrium-based modeling is incompatible with this core feature, it may not be considered as faithful to the theory it is supposed to formalize.

Clearly, the pattern of competition for the contested goods envisaged by ABCT is incompatible with a single act of equilibration. After all, under the pattern in question, at first, the originators of the excessively long investment projects are able to acquire part of the contested goods that they require at one set of prices which are lower than the prices they will face when it is discovered that they have diverted the contested goods from the closer-to-consumption projects in an unsustainable way. Two sets of prices require two instances of equilibration.

In light of this, the question becomes whether the business cycle pattern can be accounted for by means of an inter-temporal equilibrium construct. This question also needs to be answered in the negative because of the logical structure of the pattern that needs to be explained. We need to recall that in the most abstract terms, what we deal with are two types of projects which are ultimately incompatible in the sense that not enough contested goods are available to complete both of them at the prices to which the excessively long investment projects are tailored. Meanwhile, both types of projects are for some time being implemented simultaneously until their mutual incompatibility is discovered when it is reflected in the prices of the contested goods.

In other words, the formation of the second set of prices of the contested goods, which reveal the unsustainability of the excessively long projects, is not brought about by an exogenous change in which case the pattern would be consistent with the inter-temporal equilibrium. Rather, its emergence is an endogenous result of those projects' being incompatible from the start but being undertaken for some time simultaneously. In a pattern consistent with inter-temporal equilibrium, the two incompatible types of projects would have to undergo adjustment before starting to be implemented.

2.8 Chapter takeaways: the advantages of the proposed version of ABCT

To wrap up, in this chapter, a version of ABCT was developed which avoids equilibrium constructs and the pitfalls associated with trying to represent the complex pattern of production in time with the aggregative notion of a multi-stage production structure. The resulting theory also attempts to explain the business cycle in terms of the actual projects that involve key errors (the excessively long projects) and projects that compete with them. It also clarifies the source of physical scarcity (the contested goods) that ultimately renders the excessively long projects untenable or necessitates bolstering them at the expense of other economic activities.

The non-equilibrium, non-apodictic nature of the theory proposed here allows putting to rest the critiques of ABCT based on both the rational expectations perspective (e.g. Wagner (1999)) and the Austrian school's genuine uncertainty standpoint (Hülsmann (1998)). The gist of the rational-expectations critique is that ABCT seems to imply that entrepreneurs never learn from the past business cycle episodes, while Austrian subjectivists like Hülsmann take issue with the seeming determinism with regard to errors that are ultimately indeterminate.

The former critiques are rendered irrelevant by the fact that they imply that there exists a certainty or at least some objective probability of a credit expansion rendering an individual project using the excess credit becoming an excessively long project. Meanwhile, the proposed version of ABCT does not imply that whenever credit expansion by the central bank occurs, this inevitably leads to certain kind of errors being committed which answers Hülsmann-style objections.

One objection that can still be raised here, though, is that hitherto only literary reasoning has been used to flesh out the theory, and that the absence of formalization may mean that there are implausible hidden assumptions or subtle errors in reasoning involved. The next chapter will attempt to resolve this problem with an agent-based model illustration of the theory developed in this chapter.

3. An Illustration of the Restated Theory Using An Agent-Based Model

3.1 Introductory remarks

The agent-based illustration of ABCT proposed in this chapter will differ significantly from the way mathematical formalisms are used in the neoclassical approach. An agent-based computer model by definition has to be a much more specific scenario compared to a more abstract general equilibrium model.

Modern computer modeling tools provide a potentially promising alternative to mathematical modeling where mathematical modeling is not available for formal-spelling out of theories. It also allows dispensing with often very implausible assumptions that inevitably go into mathematical models because agents' preferences, capacities, behavior, and interactions may be modeled much more realistically.

For instance, in a mathematical equilibrium-based model, it is impossible to spell out that the suppliers of the affected consumer goods are not aware that the affected consumers' reservation prices are high enough to make them ready to pay high enough prices for those goods. Otherwise, in response to the higher prices for contested goods because of the additional demand from the excessively long projects (or the higher prices on inputs that became more expensive because of the increased prices of the contested goods), they would not reduce their demand for them. Rather, they would offer a price sufficient to not have part of the contested goods bid away by the excessively long projects. This would cut short the development of the malinvestment cluster.

Perhaps, more importantly, computer models allow for purely endogenous changes and responses to them. Agents can respond to conditions that came about because of the actions that happened within the model prior to their having to respond to them, whereas in equilibrium-based mathematical models, what agents do at every step of the model is determined by a set of functions that do not change depending on what happens during the modeled time interval.

To make this point clearer with regard to the version of ABCT proposed here, consider that, for instance, the affected consumers do not encounter a shortage of the consumer goods until the excessively long projects start diverting the contested goods from their production in amounts that are significant enough. Only then can those consumers be induced to signal to the suppliers of

the affected consumer goods that their reservation prices make them willing to pay more for them than before.

This is in stark contrast to the equilibrium-based models because this implies that there is no uniform demand function for the affected consumer goods that their suppliers face and that matches quantities demanded to prices that those suppliers may propose. Rather, it is the relevant consumers that propose a higher price in response to the lower quantity offered. In addition to this, there is no uniform function of the kind that is used in equilibrium-based models that could describe the excessively long projects. Until some point during the boom period, they utilize much less contested goods than they do after that point.

As will be illustrated below, computer models do not require that agents' behaviors be described by their respective unchangeable functions. Rather, it is possible to assign certain actions to agents at particular points in model time depending on the conditions that have become operative by then. This, in addition to the possibility to avoid heroic assumptions about the agents' knowledge, makes them suitable for illustrating the theory developed herein, in contrast to mathematical equilibrium-based models.

3.2 Review of the related literature and modeling tools

As computational power and the sophistication of computer software are improving, agent-based modeling is becoming a more and more widespread approach in many sciences, including economics. Currently, the literature directly applying computer modeling to illustrating the Austrian School's approach to economic analysis in general and to the business cycle, specifically, has been sparse. The only directly relevant published work appears to be the monograph by Hagedorn (2015) that proposes an accounting-based agent-based model of the economy inspired by the past versions of ABCT.⁸¹

⁸¹ The relevant agent-based model is accounting-based in the sense that every class of agents in it has its respective balance sheet and that agents behave according to the principles of accounting. It is outside the scope of this work to consider that model in detail but it needs to be noted that it is attempting to illustrate the APS-based approach to ABCT, which was shown to be largely inadequate in chapter 1.

The theoretical basis of the application of agent-based models to Austrian economic theories has also been explored by Nell (2010) and Seagren (2011). Callahan (2015) has been developing a software (Indra) specifically aimed at modeling according to the Austrian school's approach to economic analysis. However, since this project is at an early stage, it is not a first-choice tool for the current research.

With regard to the modeling tools available, there is already a rather wide selection of them, from general-application ones available on the open-source basis (for example NetLogo, RePast, MASON) to proprietary ones (AnyLogic), to ones developed by particular research teams for their own purposes (e.g. the Indra software mentioned above). AnyLogic was chosen as the tool for this work primarily because it appears to be the only well-developed software that allows combining elements of the agent-based approach with system-dynamics elements in various ways.

3.3 Preliminary considerations and outline

The model that will be described below differs from the way computer modeling is usually done in the sense that its primary objective is not to provide a sort of quasi-test of a theory through creating a substantial (up to the real-world scale) population of agents with relatively realistic characteristics and seeing what results simulating their behavior can be obtained and how they compare to the real-world results over a certain period. This may potentially be done in the future as a continuation of the research described herein but the purpose of the computer model below is a lot more modest. As stated above, the objective is primarily to see whether the internal logic of the theory outlined in the preceding chapter is coherent and if there are certain assumptions that were not explicitly formulated there but are required for the theory to be coherent.

To this end, the model will feature a relatively small population of agents with only a few consumer and intermediate goods involved. The parameters used in the model (like prices and amounts of goods produced or planned to be produced) are completely arbitrary but, as it should be evident from the model, not absurd. The numbers were chosen so that the stylized facts of the theory outlined in the preceding chapter be present.

The stylized facts in question are past prices for the relevant intermediate goods, present prices of those goods and consumer goods, expected prices, the interest rate on the loan provided to the excessively long project, the plans of the relevant agents, including the minimum profitability, and so on. Admittedly, the input numbers were chosen with the expectation of certain results of the model simulations in the scenarios that it contains.

The compactness of the modeled set of interactions does not appear to pose a serious problem since, as was mentioned in the preceding chapter, the way the theory is formulated does not require reasoning about the whole economy. Rather, the core reasoning may well be confined to the excessively long projects, closer-to-consumption projects and the consumer and intermediate goods that they involve.

A major objection that may be raised against this chapter is that the model merely takes some contrived numbers to produce a predetermined result, and, thus, does not allow to learn anything genuinely new. However, this objection overlooks the purpose of the model stated above, which is very narrow at this stage.

In addition to the above, by adding innovation to the picture the model below will showcase the superior ability and potential of computer modeling as a way of relatively formally illustrating theories about the genuinely dynamic economic reality since additional layers of complexity may be added easily without having to change other elements of the model a lot or at all.

Agents are modeled as state charts (see, for example, the state chart for consumers in Fig. 2 below) with states represented as rectangles and transitions as arrows pointing from one state to another. Each state chart has the entry point and at least one level after it. Transitions between levels and back can (in the model at hand) be determined by time elapsed since the arrival into the state the agent is currently in, a rate per period of model time and the fulfillment of conditions.

On transition into, arrival, exit from, or after a certain period of time or at a rate within, a state, agents can perform actions that are in the model at hand limited to setting the values of variables or adding to them⁸² at the 'Main' level of the model, withdrawing units from the

⁸² This is a useful way within the model of tracking the numbers of agents with a given characteristic. For instance, if an agent fails to purchase something during a step of the model it can add one unit to the number of agents who failed to purchase that good.

accumulated stocks.⁸³ Agents like consumers (as is shown below) may have their own stock-and-flow diagrams representing continuous flows of various kinds into the relevant stocks (in the consumers' case, of the money they receive at each iteration). Some transitions may involve branchings (as in the consumers' state chart), where the model may develop in one direction or the other or where some of the agents of the same category may behave in one way, and others may follow a different set of model instructions. In the case of consumers, they arrive at the 'yellow' state if there is at least one unit of CG1 available for purchase, and in the 'red' state, otherwise. The closed configuration of their state chart means that after each iteration they return to their entry point and repeat the step of trying to purchase CG1.

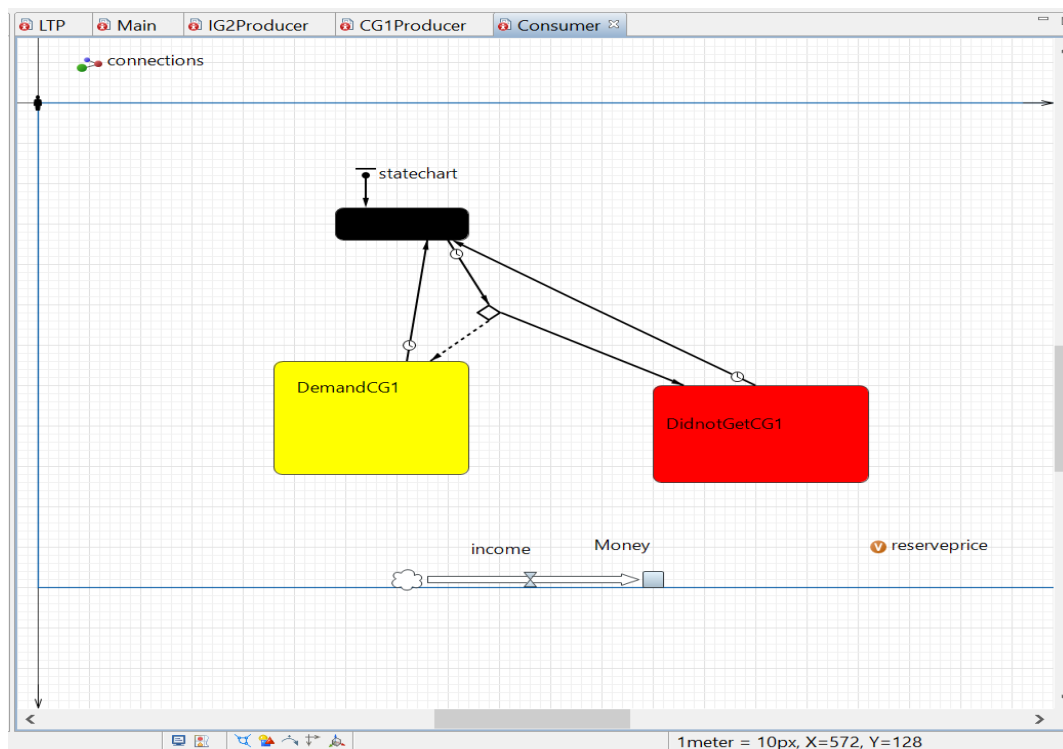


Fig. 2. CG1's state chart.

In contrast, the state chart (see Fig. 3 below) for LTP (the long-term project agent defined below) is not closed and contains several points where the scenario may take one route or another, and even provides for an opportunity for two branches to re-converge at the final level. Obviously,

⁸³ The 'Main' level in the Java-based AnyLogic software is the level whose variables may be modified by any agent and referenced by the instructions governing behavior of any agent in the model.

as in any agent-based model, the state charts for all the agents are executed simultaneously during simulation. Once the final state is achieved by all the agents, the model continues to be executed in accordance with the configuration determined by those states, as well as the states of variables at the ‘Main’ level.

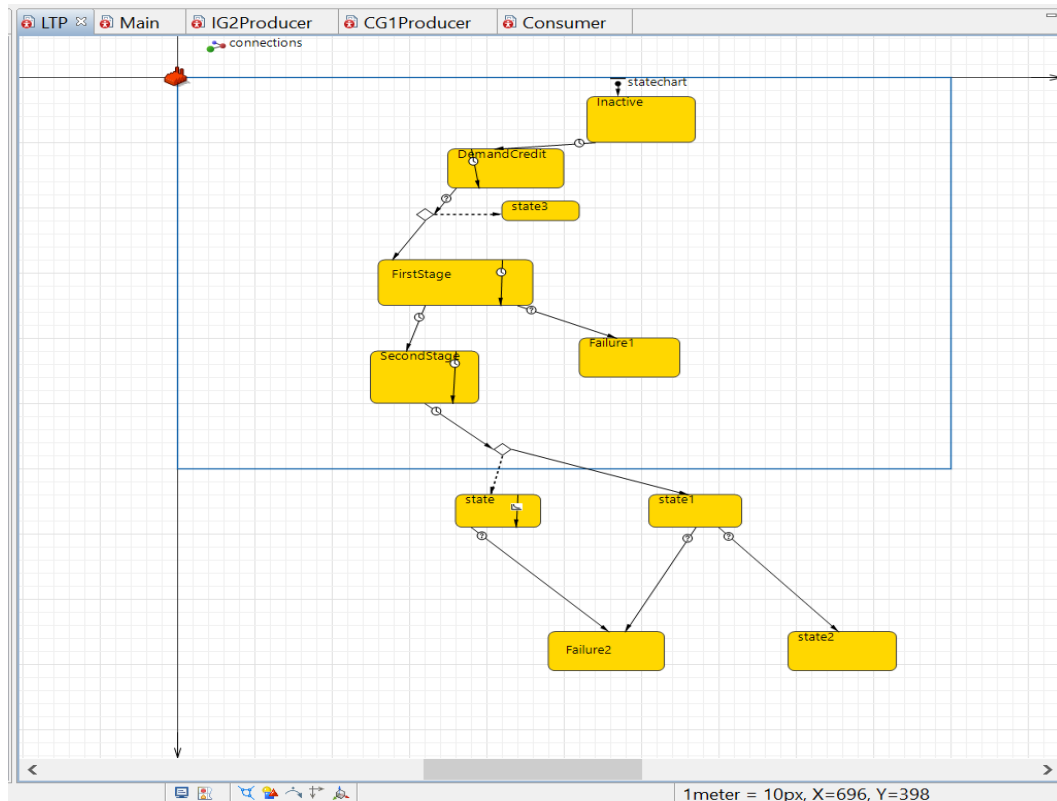


Fig. 3. LTP's state chart.

In the model at hand, the ‘Main’ level (see Fig. 4 below) contains most of the variables (even where they are parameters unique to particular agents), in order to make their behavior more tractable during simulation. It also contains stock-and-flow diagrams for the production and consumption of goods, tracking the costs being incurred by certain agents, and the state of completion of the innovation that, once completed reduces the cost of production of IG2. The relevant stocks are similar to variables in the way they are referenced in the agents’ state charts, allowing agents to respond to the value determined by a process at a given moment.

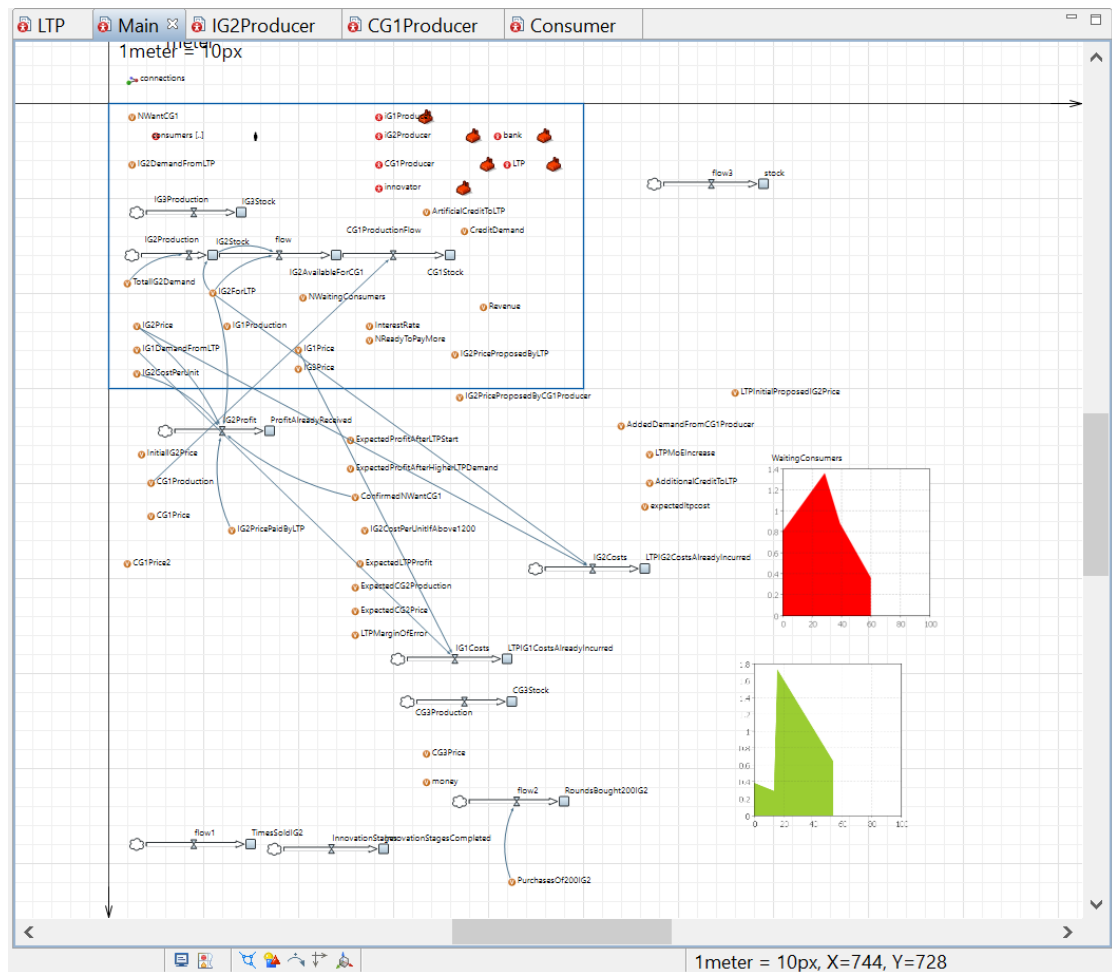


Fig. 4. The “Main” level of the model

One of the imperfections of the model is that decisions are not generalized meaning that the relevant alternatives for agents are timed. For instance, the state chart for IG2Producer only provides the possibility for it to change the price of IG2 in accordance with the proposal from CG1 Producer, only when the latter actually becomes capable of proposing a higher price for IG2. The only exception is CG1 Producer's state chart that was easier to formulate in a general fashion. This weakness may be remedied in the future versions of the model. The model also does not currently provide instructions for the agents that would apply in the case LTP were successfully completed, which may also be remedied.

3.4 The model details

The model illustrates a simplified version of the theory formulated in the preceding chapter. The simplest case of a closer-to-consumption project is chosen, namely, one involving continuous production of consumer goods from the very beginning. All the consumers are purchasing two consumer goods at every iteration of the model. The production of one of them involves the utilization of the same intermediate good as required (along with another intermediate good) for implementing the long-term project (LTP) – the contested good (IG2 in the model’s terminology). LTP is financed by a loan from the bank. Its goal is to begin producing the third consumer good. The calculations underlying LTP are based on the current prices of the relevant intermediate goods and a margin of error. Initially, LTP utilizes lower amounts of the contested good. This coincides with an innovation that lowers the cost of production of the contested good until a certain level of demand is reached. This allows the contested good producer to initially supply enough of it to cover the needs of both the consumers and LTP. When LTP starts demanding the contested good in excess of the aforementioned limit and proposes a higher price for it, the contested good producer reduces the supply of the contested goods for immediate consumer good production in favor of LTP. However, the consumers who have not been able to fulfill their needs at least in one iteration signal to the relevant consumer good producer that they are prepared to pay a higher price. This at a certain point allows the relevant consumer good producer to, in its turn, propose a higher price for the contested good. This price is unacceptable to LTP because it exceeds its margin of error, and LTP is terminated.

Goods

Consumer good 1

Consumer good 1 (CG1) is produced and distributed to consumers by CG1 Producer. It is an affected consumer good in the terminology of the previous chapter. It is produced using Intermediate Good 2 (IG2) described below. The production of one unit of CG1 requires one unit of IG2 to be made available by IG2 Producer.

Consumer good 2

Consumer good 2 (CG2) is the good that LTP is supposed to produce once the investment phase of the project is completed.

Consumer good 3

Consumer good 3 (CG3) is the good that consumers purchase at each iteration if they have enough money left in their money stocks after purchasing CG1.

Intermediate good 1

Intermediate good 1 (IG1) is used by LTP during the first 8 iterations together with IG2, after which LTP no longer needs to use it. Since IG1 is not a contested good, it is merely modeled as a constant stock-and-flow diagram without an agent that can modify it or any variables related to it, except its price.

Intermediate good 2

Intermediate good 2 (IG2) is the contested good for the purposes of the computer model, which means that it is the intermediate good for which the excessively long project competes with the production of consumer goods – in this case, CG1. For simplicity, it is assumed that each unit of CG1 requires one unit of IG2 to be produced.

The production of IG2 involves explicitly described production costs per unit. The model does not use an explicit production function for IG2 since this is beyond the scope of the model. Instead, based on the three production numbers used in the model (1000, 1100 and 1200 units), it has a specific cost per unit depending on which of the two scenarios is being simulated. The differences in scenarios are described further below.

Intermediate good 3

Intermediate good 3 (IG3) is the intermediate good that LTP is supposed to utilize to produce CG2.

Agents

The model includes the following agents: a population of 1000 consumers, LTP, CG1 Producer, IG2 Producer, the bank and the innovator.

Consumers

There are 1000 consumers in the model. They are all demanding the affected consumer good CG1 during the time the LTP is implemented, hence they are the affected consumers in the terminology of the preceding chapter. They are modeled as agents each of which has the same

preferences and the same responses to changes. At each iteration of the model, all of them attempt to buy one unit of CG1 and two units of CG3. It is assumed that, although other agents in the model are not aware of this, each consumer is prepared to pay \$7 per unit of CG1 if she has to, despite the fact that the price of CG1 is initially set at \$5. Consumers are prepared to pay \$7 per unit of CG1 by means of foregoing the consumption of CG3, if necessary.

Each consumer has a stock-flow diagram assigned to her that models the flow and stock of monetary units that she can spend to purchase consumer goods. Those consumers who succeed in purchasing units of consumer goods withdraw those units from the relevant stocks, as well as the monetary amounts that they paid. At the end of the iteration, they revert to their initial state and so on. At every iteration, those consumers that failed to acquire a unit of CG1 (which is tracked by the amount of money left in their stocks) signal to CG1 Producer that they are prepared to pay a specific higher price that is set as uniform for all of them for the purpose of simplicity. The consumers who propose a higher price pay this higher price by means of not consuming the second consumer good CG3 in the relevant iteration.

Consumer good 1 producer

CG1 Producer in the model represents closer-to-consumption projects as defined in chapter 2. For the sake of simplicity, a continuous production process of consumer goods is chosen for this purpose rather than a project that would result in a significantly higher production of consumer goods during the boom period than LTP or that would facilitate such production through delivering an intermediate good.

In producing CG1, CG1 Producer is targeting a minimum profit of \$1000 per step of the model. Its profit as calculated as the difference between the sales of CG1 and the money it has to spend on IG2. Since at least at the moment, the focus of the model is on how the competition between CG1 Producer and the LTP described below leads initially to a decrease in production of CG1 and then to CG1 Producer being able to bid up the price of IG2, the detailed way CG1 Producer responds to possible configurations of consumer demands versus IG2 costs is not relevant here. It is simply postulated in the model (and the numbers are chosen accordingly) that if the minimum level of profit is achieved, CG1 Producer will satisfy the consumers' demand.

When the additional demand for IG2 arises, the aforementioned configurations do not matter for the initial decision of CG1 Producer to not bid up the price of IG2 because it operates on the assumption that no consumers are prepared to pay more than the current price of CG1. Thus, when IG2 price is initially bid up for some units of IG2, CG1 Producer's unpreparedness to pay a higher price for them automatically leads to the relevant amount of IG2 being diverted from CG1 Producer and for the corresponding reduction in CG1 production.

LTP

LTP (the long-term project) is an agent element of the model that is supposed to illustrate what happens to excessively long projects discussed in the preceding chapter. LTP is modeled as an agent that has a plan to receive a credit from the bank and use it to purchase two intermediate goods during a certain period and then produce CG2 for a certain defined period. It uses the expected price of CG2 in that future period, the current prices of the intermediate goods, the interest rate and a margin of error to calculate the expected profit of the project. A significant dose of realism is thus added into the model, as LTP's plan has a finite temporal horizon.

More specifically, LTP applies for a credit from the bank in the amount of the total expected cost of the intermediate goods plus the margin of error that is calculated as 25% of their current prices per unit times the number of units times the number of steps at which they are planned to be used. When LTP receives the credit, it proceeds to buy 100 units of IG1 and 100 units of IG2 during 8 steps. Then, it stops using IG1 and starts demanding 200 units of IG2. Before starting to demand 200 units of IG2, it offers to IG2 Producer a higher than the then-current price.

In addition to this, shortly after starting to implement the project, LTP checks whether the prices of IG1 and IG2 have changed. If they have, it affects LTP's expectations about how their prices are going to evolve and it doubles the margin of error. If the situation changes such that the total cost of the project exceeds the amount of the loan, LTP terminates. In the model, this is reflected in its demand for intermediate goods which falls to zero. The way the condition is stated implicitly references the margin of error that is crucial to the version of ABCT that is illustrated because the amount of the loan explicitly includes only the margin of error the originally expected intermediate good prices as variables. In other words, when comparing the expected total cost to the amount of the loan, this implies a comparison of the increase in costs and the margin of error.

LTP's plan involves purchasing 100 units of IG1 and 100 units of IG2 for eight steps of the model and then using only 200 units of IG2 for the following forty steps before producing CG3 during 50 steps. LTP plans to repay the amount of the loan (\$49 000) plus interest (2% per step) during those same 50 steps. The margin of error initially set by LTP is \$9 800.

Intermediate good 2 producer

Intermediate good 2 producer (IG2 Producer) is responsible for distributing IG2 among agents competing for it. Over the duration of the model (110 steps), it is targeting the minimum profit of \$110 000. If at a certain step, based on the current price of IG2 and its per-unit cost of production, the expected profit falls below the threshold, IG2 Producer reduces the production of IG2 and since at that moment in the model, LTP proposes a higher price of IG2, the supply reduction happens at the expense of consumers since IG2 Producer does not know that CG1 Producer could raise the price of CG1 because consumers' reservation price is higher than the current CG1 Price.

Innovator

The Innovator is modeled as an agent that at several steps of the model either changes the default cost structure of producing IG2 or preserves the status quo, depending on whether the innovation process is complete. The innovation process is modeled at the *Main* level of the model as a stock-flow diagram which executes a certain number of innovation steps per iteration of the model. The innovation is completed when 10 innovation steps have accumulated in the relevant stock.

For the purposes of illustrating ABCT, two scenarios are used. In the first scenario, one innovation step is accomplished per each iteration. Thus, by the moment LTP starts demanding IG2, the costs of producing IG2 become the following:

- 2.5\$ per unit if the total demand for IG2 is less than 1100 units per step;
- 3\$ per unit if the total demand for IG2 is higher than 1100 units per step but less than 1200 units;
- 4\$ per unit when the total demand is higher than 1200 units.

In the alternative scenario, the speed of the innovation process is set at 0.1 steps per model iteration, such that the innovation is far from complete when LTP is launched. Hence, the cost structure faced by IG2 Producer is the default one:

- 3\$ per unit if the total demand for IG2 is equal to 1000 per step;
- 4\$ per unit if the total demand for IG2 is equal to 1100 units per step but less than 1200 units;
- 5\$ per unit when the total demand is equal to 1200 units.

Bank

The Bank is an agent of the model whose only function is to issue a loan to finance LTP and set the interest rate on it. In the future, the complexity of the model may be increased by having two or more banks and more projects for them to finance of which LTP would be the longest one. However, here we are only interested in illustrating the central point of ABCT, namely how competition between excessively long projects and consumer good production may lead to the abandonment of the former.

3.5 The two scenarios of the model

3.5.1 Scenario 1

As was mentioned above, the first model scenario involves the innovation occurring by the moment LTP starts demanding IG2. This changes the cost of IG production and allows IG2 Producer to produce enough IG2 to satisfy the demands of both the consumers and LTP, as long as LTP demands only 100 units per step of the model, without raising the price of IG2.

However, when LTP has to increase its IG2 demand, IG2 Producer cannot maintain the desired profitability through producing 1200 units because the per-unit cost of IG2 production has increased. It reduces the production to 1000 units, of which it assigns 200 units to LTP because

LTP agrees to pay a higher price for IG2 (\$4.5 per unit) that CG1 Producer is not prepared to pay. This results in there being 200 unsatisfied consumers at each step of the model. The crucial element here is that CG1 Producer is not aware of the fact that consumers have a higher reservation price (\$7) for CG1 than the price (\$5) they initially pay. It is only able to discover it when some consumers unable to buy CG1 signal their preparedness to pay more.

Throughout the model, each consumer receives \$7 at every step. In the beginning, the price of CG1 is \$5 per unit, and the price of CG3 is \$1 per unit. If a consumer is able to buy 1 unit of CG1 she then buys two units of CG3. At the first moment that a consumer is unable to buy CG1 she does not buy CG2, either, and signals to the CG1 producer her preparedness to pay \$7 for one unit of CG1. If a consumer did not manage to buy CG1 at a preceding step but is able to do it at the current step, she buys 1 unit of CG1 and two units of CG3 but still signals to the CG1 Producer that she is prepared to pay \$7 for CG1. If a consumer is unable to buy CG1 more than once, she buys two units of CG3 and signals to CG1 Producer that she is prepared to pay \$7 per unit of CG1.

In the first scenario, until LTP's demand for IG2 reaches 200, CG1 production is not affected but when it is, at each step 200 consumers are not able to buy a unit of CG1. With the situation progressing more and more consumers have been unable to purchase a unit of CG1 at least once and more and more consumers signal their preparedness to pay \$7 until the number of the latter consumers reaches 400 where it stays constant. Logically, this should not be the case because the assumption is that the consumers who happen to be unable to buy a unit of CG1 at each step get into this situation randomly. This should have resulted in the number of consumers ready to pay \$7 reaching 1000 because each consumer who was unable to buy CG1 at preceding step(s) retains at least \$7. It appears that the AnyLogic 7 software does not select which agent elements are withdrawing units from stocks in which order in a quasi-random fashion. Which results in some elements never failing to withdraw their units from the stock.

This issue is an interesting avenue for further research, including a potential collaboration with AnyLogic developers because the power and realism of AnyLogic software at least in respect of modeling economic processes would certainly increase if the order at which agents withdrew units from stocks were randomized. Nonetheless, this does not pose a fatal problem for using Anylogic for illustrating ABCT because the core idea is that consumers' additional demands signaled to the consumer good producers utilizing the contested goods prompt the latter to

eventually bid up the prices of contested goods, which frustrates the plans underlying the excessively long projects. In the current version of the model, an arbitrary cut-off point (number of consumers prepared to pay \$7 per unit of CG1 equal to 390) is chosen at which CG1 producer boosts the price of CG1 to \$7, demands additional IG2 from the IG2 Producer and bids the price of IG2 to \$6. In the simulation of the model, this happens at $t=28$. At $t=29$, LTP has already spent a part of its \$9800 margin of error because it paid additional \$0.5 per unit of IG2 during the preceding steps. Now, it remains for it to pay \$2 more per unit of IG2 during 31 step (i.e. \$12,400), which alone is far more than even the original margin of error. LTP reduces its demand for IG2 to zero because the project becomes incompatible with its preferences.

Fig. 5 below shows the evolution of the number of consumers who did not manage to buy CG1 at each step. In the beginning, there are no such consumers, then when LTP starts demanding 100 units of IG2, IG2 Producer has to increase the production of IG2 by 100, it takes time for the relevant stock-flow diagram to settle down, which leads to some consumers being unable to buy CG1. When LTP starts demanding 200 units of IG2 per step, IG2 Producer reduces the IG2 flow for CG1 production by 200 units but the number of consumers unable to buy CG1 per step does not reach 200 immediately because of the same feature of stock-flow diagrams in AnyLogic. Finally, when at $t=29$ LTP reduces its demand for IG2 to zero, the number of consumers unable to buy CG1 goes down to zero.

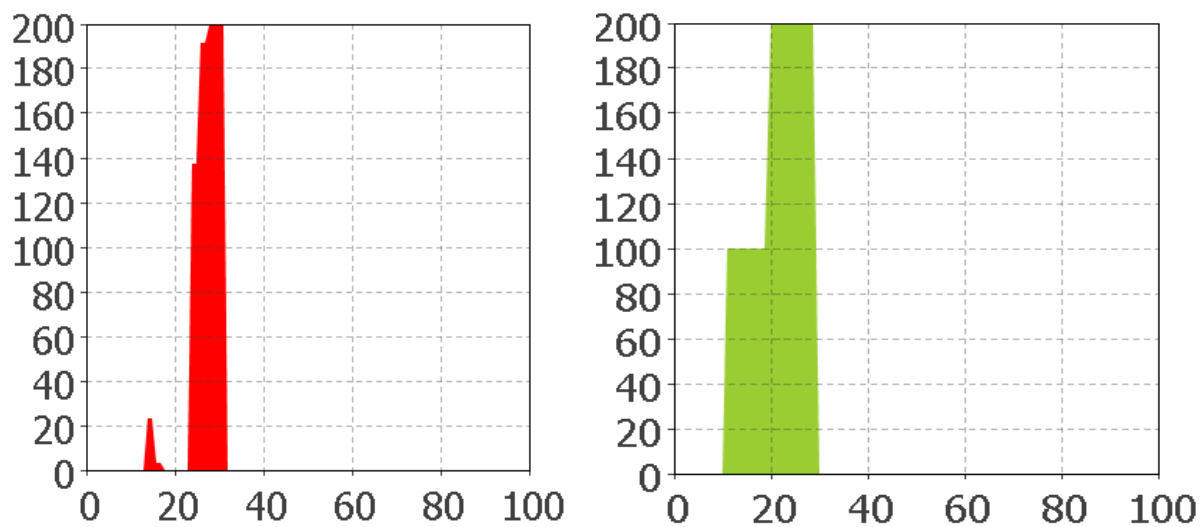


Fig. 5-6. Number (N) of consumers who did not receive CG1 at successive model times (t – X-axis; N – Y-axis); IG2 demand from LTP (Scenario 1)

At the same time, Fig. 6 illustrates the demand for IG2 from LTP. It is clear from the graphs that LTP's demand for IG2 falls to zero at the same model time as the number of consumers who did not receive CG1, which is exactly what the model is supposed to demonstrate.

3.5.2 Scenario 2

Scenario 2 begins similarly to scenario 1 but when LTP starts demanding 100 units of IG2, since the per-unit cost of production of IG2 has increased with the increased total demand for it, IG2 Producer has no choice but raise the price of IG2 to maintain the minimum desired profitability (that is equal to \$1 per unit sold in our simple calculation).

At the same time, the assumption of the model is that when facing an early rise in IG2 price, LTP's originator reconsiders its view of the situation and considers doubling its margin of error. However, the only way LTP originator can achieve this is through borrowing this amount from the Bank. LTP's originator then calculates the expected profit of the project given the need to borrow additional funds from the bank and finds that it is lower than the minimum profit she would accept. She decides to abort LTP. The graphs from the simulation of Scenario 2 of the model in Fig. 7-8 reflect this. Since LTP's originator aborts the project before it starts to be implemented, no IG2 is ever diverted from producing CG1. Thus, at no point are there any consumers who fail to purchase CG1 (Fig. 7).

At the same time, Fig. 8 illustrates how IG2 demand from LTP briefly rises from zero to 100 units, which alerts IG2 Producer that it would face higher costs if it were to satisfy the additional demand. It then falls back to zero when IG2 Producer signals that LTP will have to pay a higher price for IG2 and LTP decides that the project is no longer worth pursuing because of the expected profit falling below the acceptable minimum.

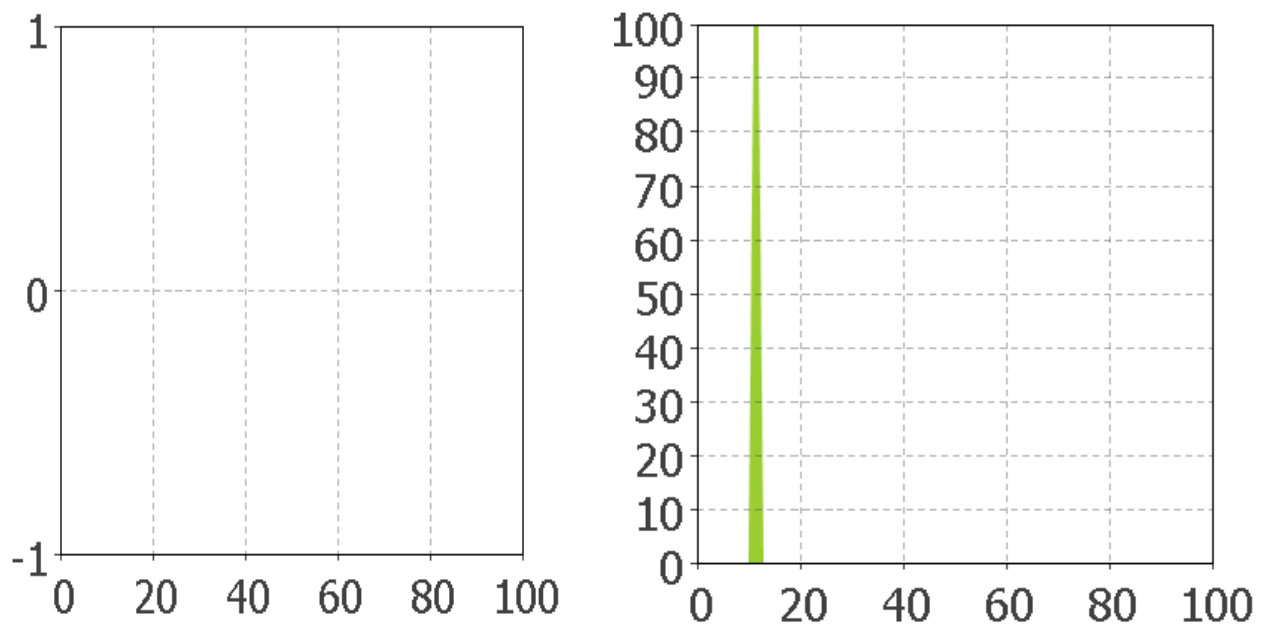


Fig. 7 – 8. Number (N) of consumers who did not receive CG1 at successive model times (t – X-axis; N – Y-axis); IG2 demand from LTP (Scenario 2)

3.6 Discussion

The model outlined above appears to show that with admittedly arbitrary figures selected to fit a preconceived outcome, the scenario envisaged in the version of ABCT developed in the preceding chapter is realizable without the need of unrealistic assumptions and with several clarifications discussed below.

The model contains important simplifications, especially if taken as the model of the whole economy, which, as was mentioned above, it does not have to be. In particular, the question of how consumers receive the money that they receive is disregarded. Also omitted is labor as the factor of production, and the potential effects arising from consumers being employees of one of the enterprises represented by the agents of the model. Nevertheless, the model described here is not supposed to be the last word. Its objective is to illustrate the logical coherence of the central point of the version of ABCT in question, as well as to showcase the potential of mixed agent-based/system-dynamics models for illustrating genuinely dynamic economic theories.

One of the key contributions the model makes to the work herein, besides providing a formal verification of the core of the theory, consists in clarifying one of the potential mechanisms of how the increased initial demand for the contested goods coming from the excessively long projects does not result in an increase in their prices, as well as potentially solving the conundrum of how the malinvestment boom may coincide with increased consumption.

As was mentioned in the preceding chapter, one of the crucial questions regarding the version of ABCT sketched there is how the increased demand for contested goods from the excessively long projects does not immediately result in higher prices. If this were the case, this would signal to the originators of the excessively long projects that their newfound financial viability is illusory and tend to negate the effects of the expansionary monetary policy.

The model described in this chapter provides a clue to this problem by virtue of three elements:

- 1) The demand from LTP for the contested good IG2 is initially set two times lower (100 vs 200 units) than it becomes after the first 8 purchases;
- 2) The moment when LTP starts demanding IG2 coincides with the completion of the innovation that reduces the cost of production of IG2, which allows IG2 Producer to keep IG2 Price constant. The production cost decrease is, however, insufficient for allowing IG2 Producer to not increase IG2 price after LTP's demand for IG2 reaches 200 units.
- 3) The producer of the contested good IG2 is not aware that the closer-to-consumption project operated by CG1 Producer may demand a higher price for IG2 since CG1 Producer itself is not aware that the consumers' reservation price for CG1 is significantly higher than the price they initially pay.

It may have been possible to keep the model simpler by retaining only the first and third of the aforementioned elements and just tweaking the calculations underlying LTP such that the increase in prices caused by the initial magnitude of demand increase does not exceed LTP's margin of error. Alternatively, LTP may have been modeled as initially not using the contested good at all. The decision to render the model somewhat more complex was partly motivated by the desire to showcase the potential of computer modeling for including genuine innovation, and

partly by the need to make ABCT-described booms compatible with empirically observed economic growth.

The inclusion of genuine innovation into the model also goes some way towards addressing one of the main criticisms raised against ABCT that it is unclear how to make the theory compatible with the genuine economic growth that takes place simultaneously with the cluster of erroneously undertaken investment projects. The version of ABCT outlined in the preceding chapter partly responds to the criticism even without the extension provided by the computer model since it allows to limit the theory to particular sets of the excessively long projects, closer-to-consumption projects and contested good production. But the computer model makes the case even stronger by suggesting that innovations may allow adding excessively long projects to the economy without immediate consumption decreases. While the model does not go further in this sense to show how the innovation in question may temporarily increase consumption, the relevant extension can easily be added by including employees working for IG2 Producer and allowing IG2 Producer to hire more of them or increase their pay in response to the innovation in question allowing it to increase IG2 production.

The concluding part of this volume will briefly discuss how the computer model developed here may be improved further and made more complex and realistic. Meanwhile, the fact that the model allowed verifying the logic of the core pattern of ABCT makes it possible for us to move to the next step, namely, the application of the theory to the empirical reality.

4. Applying ABCT to Historical Episodes

4.1 General remarks

The theory that was formulated and illustrated with the help of an agent-based computer model in the previous chapters is, admittedly, not an ordinary kind of theory in modern economics, and this inevitably has an impact on the way the theory can be applied to historical evidence. However, before we touch upon its particularities, the use of the term “application” needs to be explained.

Normally, when modern economists talk about the relationship between theory and empirical evidence, they talk about testing theories, either by means of controlled or natural experiments or statistical methods (especially econometrics). Obviously, controlled or natural experiments are practically almost impossible in the macroeconomic domain in general and with regard to the business cycle phenomenon in particular. In addition to this, as will be discussed below, the nature of the theory sketched out in this work largely prevents it from being tested econometrically, even if econometric tests could be genuinely conclusive, which they do not appear to be at least at the moment.⁸⁴

There is, however, an alternative approach to the Popperian hypothesis-and-test paradigm with respect to applying theory to history. This approach received its fullest exposition as of today in the work of Ludwig von Mises (2007 (1957)). But it arguably received much better treatment from Long (2004).

The empirical methodology of the Austrian School to which this work also adheres involves starting from the basic facts about certain economic phenomena that we can arrive upon through introspection and the use of those facts in conjunction with other basic facts about the

⁸⁴ If one considers the key debates in modern economics, for instance, the question whether minimum wage laws have a net negative or positive effect, or whether monetary or fiscal stimulus may jolt economies out of recessions, there has been a wealth of econometric treatment of the relevant data, but, so far, despite decades of research, there are no signs of approaching consensus. This might suggest that at least in economics, statistical methods may ultimately be unsuited for adjudging between various explanations, despite their increasing rigor and sophistication. Discussing this issue in depth, however, would take us far beyond the intended scope of this work.

world⁸⁵ to derive logically coherent theories that are bound to also be correct because they are based on empirically valid premises.

Long attempts to respond to the neoclassical critique of the methodology of the Austrian School that it is unclear how logically incontrovertible theories may have their counterparts in the real-world phenomena. In particular, Long discusses the hypothetical example of seemingly irrational wood-sellers who exchange something that resembles money for piles of wood depending on what area those piles cover:

Why do the wood-sellers seem irrational? Consider: I could buy a tall, narrow pile of wood from them for a low price, rearrange it, and then resell it to them at a high price. How can they guard against being exploited in this manner? For that matter, if they can get a higher price for short, wide stacks than for tall, narrow ones, why don't they rearrange their own narrow stacks and sell them at the higher price? From an economic standpoint, if they know that the less valuable stacks can be transformed into the more valuable ones by means of simple rearrangement, then the less valuable stacks are a higher-order or producer's good, a means of producing the more valuable stacks, and the value of the end should be imputed back to the means (Mises 1996:200, 333–335). So the difference in price between the wide stacks and the narrow ones should dwindle until the price one is willing to pay for a narrow stack equals the price one would pay for a wide stack minus whatever utility is lost in the effort of rearranging the stack. Suppose most people are willing to pay no more than \$5 to avoid the hassle of having to rearrange the stack. Then, if they are rational, they should not be willing to assign more than \$5 worth of difference between the two stacks. Suppose two stacks, equal in (what we would call) quantity of wood, are being offered for sale, the narrow one at \$100 and the wide one at \$200. Why should anyone buy the wide one? The cost of choosing the narrow one and then rearranging it into the preferred type of stack is \$100 for the wood plus the psychic equivalent of \$5 for the labor—still a savings of \$95. Every rational person will choose the narrow stack over the first. Sellers of wide stacks will have

⁸⁵ The facts in question are basic in the sense that they do not require studying multiple instances of the same phenomenon to then inductively generalize about it. For instance, it is not necessary to study millions of uses of money to realize that it is a general means of exchange. Which, in its turn, implies that holding it allows to obtain most other goods, therefore, a rational economic agent will prefer holding more of it to holding less if that is the choice she faces.

to lower their price to \$105 or less before they can compete with the sellers of narrow stacks. If that is not what happens, then people have not acted in accordance with their presumed preferences. If the wood-sellers really prefer wide stacks to narrow ones, and more money to less, then their pricing practices are irrational.⁸⁶

The key idea of the hypothetical is that, in theory, the nature of money as a universal means of exchange dictates that a rational person who holds money will not exchange an object for a certain sum of money merely in order to quickly buy essentially the same object back for a higher amount. The fact that it is conceivable that some people could use money in that way may suggest that real-world experience involving money may contradict the logically coherent basic theory of money, i.e. the inference discussed in footnote 86 that an economic agent will prefer holding more money to holding less.

However, Long rightly responds to this that the whole problem arises only if we infer from the exchange that takes place that the objects that the wood sellers accept for their wood are units of money, whereas there is no clear reason to make this conclusion. Whether a certain type of material objects qualifies as money is not reducible merely to its physical properties such as relative scarcity, portability, fungibility, etc. Rather, a certain type of collective understanding should exist with regard to that type of objects that it is usable as a general means of exchange. From the fact that wood sellers in the hypothetical clearly do not treat the seemingly monetary objects as units of a general means of exchange one can infer that those objects are not actually money and the hypothetical does not contradict the basic monetary theory.

Put differently, logically derived economic theories only apply to real-world situations which feature the referents of the concepts employed by those theories. If objects used in exchanges are money, money-using agents may not sell the same thing for a certain amount of those objects and then buy it back at a higher price just because the thing was rearranged without anything changing about it in a meaningful way.

It may be objected here that this approach is irredeemably circular but it only seems to be so because it seems to imply that someone can always deny that, for instance, certain exchanged items are monetary commodities, when they display properties that are inconvenient for the theory.

⁸⁶ Long, 2004, p. 352.

However, what is really meant is that we do not have to know everything about a concept in order to recognize instances of it in the real world and rule out other phenomena as its referents. More precisely, we do not have to know everything that can ever be known about the concept of money to distinguish genuine examples of it from, for example, the means of the unconventional exchange from the hypothetical discussed by Long.

If this still sounds implausible one should consider an analogy from outside economics. Consider the statement that a sufficiently rigid square peg may not be fitted into a round hole in a sufficiently rigid substrate. The reason why this statement is true is based on the basic facts of the world that do not require controlled experiments to be established. Basic geometry and acquaintance with rigid objects are sufficient here. However, what if someone observed that what looked like a sufficiently rigid peg was inserted into what looked like a sufficiently rigid surface through applying a lot of force to the peg and deforming it to enter into the hole? The correct way to respond to this is to say that the notion of fitting a peg into a hole does not allow for deforming the peg in the process.

At the same time, the basic facts about pegs and holes of certain shapes and rigidity do not allow one to answer all the questions that can be asked about the hypothetical situation in question. One cannot deduce, for instance, whether the person who pushes on the peg will experience discomfort because of her effort, how much heat will be generated in the process and so on. Put differently, the basic theory of pegs and holes allows us to answer certain questions about actual situations involving pegs and holes but not all the questions, and this does not detract from the usefulness of the theory.

It is in the sense that we may talk about the “application” of ABCT to historical examples. The computer model developed in the preceding chapter bolsters the idea that the internal logic of the theory is coherent. Hence, it is possible to look at the given historical episode and to see whether it contains the referents employed by the theory such as the excessively long projects, the closer-to-consumption projects, the contested goods, etc. If it does appear to contain them, we may then claim that ABCT is applicable to it, or that the period in question contained the pattern envisaged by ABCT.

However, the mere question whether ABCT applies to a certain historical episode is not interesting enough in its own right. Given that it is a theory of boom-and-bust patterns, the second major question that needs to be answered is what part of the economic fluctuations it explains in the given case. Another interesting avenue for the application of ABCT to historical episodes is the analysis of the ways the cluster of excessively long projects interacted with other economic developments in the economy in question at the period under consideration.

In addition to what was just discussed, the general nature of the application of ABCT to history in line with the approach analyzed above has an important implication. Given that the theory is formulated in terms of particular projects and goods for which they compete in a given episode, it does not easily permit simultaneous analysis of multiple historical episodes through its lens with the application of the econometric methodology. The reason for this is that the econometric approach of testing hypotheses on a sample starts with the outcome and the potential causal factor and considers whether the link between them is truly likely to be causal. In the case of ABCT, it needs to be shown that the elements in question were present during a given historical episode. Once this has been accomplished, though, there is no need to further demonstrate causality because it is already inherent in the mutual interrelatedness of the concepts such as the excessively long projects, the closer-to-consumption projects, the contested goods, and so on. This, however, does not preclude the use of econometric methods where it may facilitate determining whether a given phenomenon is an instance of one of the elements of the theory. However, they are likely to be of secondary significance in the qualitative empirical analysis in any case.

There are several important caveats that need to be made with regard to this approach. To start with, no matter how systematic the guide to the empirical application of the theory to historical episode becomes, it is not possible to completely outline all the possible branchings that the empirical analysis could take, all the scenarios and all the types of the indirect evidence that can be used in order to verify the usefulness of the theory in each instance of application.

This does not have to be a downside of the theory, though. One of the fundamental insights of the economists of the Austrian school whose tradition this work attempts to move forward is that the economic reality is very complex and complex in a dynamic sense. The latter means that there can be mutual feedbacks among various factors involved playing out in real time. It is difficult to give an exhaustive list of the possibilities. In other words, given the qualitative nature

of the empirical analysis proposed in this work, the complexity of modern economies, the relative uniqueness of each historical episode, and the fact that the availability of various types of data may vary significantly, the methodology of empirical application of ABCT may not be algorithmic, i.e. involve a fixed set of rigid steps. For example, in the process of studying a given historical episode, evidence may be found that may not be anticipated in the discussion below and that may warrant additional analytical steps or override certain elements of the general methodology.

It also has to be acknowledged that no boom and bust episode will involve just a sea of economic normality with the island of ABCT-described malinvestments in the middle of it. Credit expansion that may create the latter may also, for instance, serve as a form of subsidy for certain kinds of activities. Both of the aspects may be present in particular historical episodes, and if the subsidy is significant enough, its reversal may create crisis effects on its own, especially when it is accompanied by other factors. This may result in the need to attempt to distinguish the effect of the cluster of malinvestments from that of the withdrawn subsidy.

In addition, in an open economy, economic troubles may to a certain extent arrive from abroad. For instance, an economic crisis in other countries who are major importers of the goods from the country in consideration may lead to lower demand for some of its exports and reduce its output in this way, as well as the ability of some companies to import the inputs they may need for their production.

The most important potential issue, though, concerns the reflective equilibrium approach to identifying the referents of the elements of the theory in particular historical episodes. In particular, it may essentially be argued that the empirical analysis may not even start because identifying one element requires identifying all the others but each of the latter requires identifying all the others except for it.

The scope of this work does not allow addressing this potential objection at length but let us briefly consider as an example how one may start identifying the excessively long projects without identifying any other elements of ABCT prior to that. There are at least two features of the excessively long projects that do not reference other elements of the theory: the excessively long projects should form an identifiable cluster whose elements all start following the credit expansion by the central bank and are financed at least partly by means of bank credit or other

forms of bank-credit-facilitated borrowing.⁸⁷ Secondly, the originators of the projects forming the cluster must start facing financial difficulties at a certain stage before their completion. This may manifest itself either through the projects being abandoned, put on hold or scaled down or through their originators reducing spending on other activities.

Once the features of an element that do not reference other elements are established, it may be said that we have a candidate element, and once all the candidate elements are present, it becomes possible to start considering whether the candidate elements in question stand in an arrangement of relationships among themselves that mirrors the one envisaged by the theory. If that is the case, then it can be concluded that a given historical episode is an instance of the pattern envisaged by ABCT.

It should be noted, however, that given the scope limitations and tractability considerations, all the steps of the approach sketched out above do not have to be traced out in an explicit fashion. In a similar manner, when neoclassical economists propose models for capturing what they see as essential features of certain phenomena, they generally do not establish the correspondence of every element of the model to every element in the reality it is supposed to reflect to a certain extent. Hence, the empirical application of ABCT attempted here does not explicitly outline all the relevant steps, leaving it to the critics to identify instances where the proposed candidate elements of the ABCT-envisaged pattern from a given historical episode do not actually qualify as such.

The rest of this chapter will briefly address what features the instances of the elements of ABCT in particular boom-and-bust episodes may exhibit and which problems their identification may encounter.

4.2 Preliminary analysis of the period under study

When a certain historical period for a given economy is chosen for analysis because it featured what appears to be a business cycle pattern, the first research step is to give a brief

⁸⁷ For the sake of simplicity, in the empirical analysis of the U.S. Great Recession in the following chapter, only bank loans are considered as the channel of credit expansion.

overview of the period to determine, first, whether significant credit expansion was present, and whether part of it was allocated to lending aimed at relatively long-term investment projects. The second element is essential because, as was mentioned in chapter 2, the excess credit created because of loose monetary policy may well be allocated to activities that do not qualify as excessively long projects in view of their relatively short duration.

To start establishing the presence of credit expansion, it is important to, first, consider the monetary stance of the central bank. There are various indicators of the monetary policy stance that can be used. Perhaps, the most important one is the rate at which banks lend to other banks their reserves overnight which in the U.S. is referred to as the Federal Funds Rate. It is this rate that most central banks target with various policy instruments that are available to them as a proxy for other objectives.

A period of loose monetary policy, as evidenced by the overnight reserve lending rate may be characterized by its prolonged decrease compared to the initial level. The case for loose monetary policy is strengthened if the available research indicates that the pattern of this rate deviated from the commonly accepted rules for monetary policy-making, such as the Taylor rule.

Once there is significant evidence for loose monetary policy during a boom-and-bust episode, it is important to verify whether at least part of the excess credit was allocated to relatively long-term investment projects. To achieve this, the distribution of the total amount of loans outstanding during the period may be studied. If a certain category or categories of loans that fit the bill in terms of the underlying projects undergo a substantial, lasting increase in the total amount of such loans outstanding after the loose monetary policy stance of the central bank becomes apparent, one can move on to identifying the candidate elements of the ABCT-envisaged pattern. Once all the candidate elements are identified, one may proceed to estimate the size of the cluster of excessively long projects during the episode under analysis.

4.3 Identifying the candidate cluster of excessively long projects

In a study of an actual historical business cycle episode, it might not be easy to directly identify the candidate erroneously undertaken investment projects that correspond to the characteristics proposed by ABCT. Typically, with very rare exceptions,⁸⁸ there is no concentrated and systematized information on investment projects, and even if it is possible to collect some information from disparate sources, it will probably be insufficient for analyzing investment projects directly. Some way to make a proxy analysis must, thus, be found.

We can begin to address the issue of finding such a proxy with an observation that while the length of the lag between the beginning of the credit expansion and the launching of the excessively long projects is not determined, in order for those projects to create a substantial misallocation of resources, they must take a substantial time to be completed. The projects in question by their very definition also should not directly or indirectly result in the production of consumer goods during the period of the boom at least close to their full capacity. These two ideas have an important empirical implication when coupled with another observation. At least the modern production processes are not slow enough for the aforementioned conditions to be fulfilled by projects only involving the production of new equipment⁸⁹ or expanding production of the existing equipment or renovation of the existing equipment.

The key implication is, thus, that excessively long projects must comprise investment into building new or expanding the existing nonresidential structures, such as plants, warehouses, mines, power plants, electricity or electric and radio signal distribution networks (e.g. cellular towers), hotels, wholesale and retail trade centers, hospitals, ports, etc. Some kinds of residential structures that take substantial time to complete are also relevant, such as large-scale condominium developments popular in the US. While there are certain types of equipment that may take a lot of time to produce (such as large ships), they do not seem to be consequential enough on their own to produce fluctuations in the modern economy.

⁸⁸ If there was a certain concrete type of projects that manifestly faced trouble during the period there may be research or media coverage of it. In the next chapter, an example of projects involving coal-fired power plants in the U.S. is briefly discussed.

⁸⁹ In this research, the classification of investment by type follows the one used by the US Bureau of Economic Analysis (BEA). BEA breaks investment down into three major types: investment into equipment, structures and intellectual property. The investment into structures is further classified into the investment in residential and nonresidential structures.

Alternatively, excessively long projects may not, at least initially, involve construction activities at all, and consist in research and development of new products, especially those products that due to various (including regulatory) reasons may take long spells of time to complete. In chapter 2, such excessively long projects were referred to as the excessively long projects abandoned at the preliminary stage. Pharmaceutical drug development that usually needs to pass through a number of stages between the formulation of the idea of the compound and its commercial availability, such as the determination of the best ways to deliver the compound and the right dosage, as well as multi-phase clinical testing, is a good example of such projects. Not much physical investment may be required given the relative non-specificity of pharmaceutical facilities and equipment, like centrifuges, but the process may still be highly resource-consuming with tangible economic consequences.

To summarize, the following general types of investment projects may, in principle, qualify as excessively long:

- 1) Projects involving the creation of new lines of production (for example for producing a new model of an automobile) and (or) new industrial structures;
- 2) Projects involving research, development, and launch of production of entirely new products (think of the introduction of touch-screen smartphones or pharmaceutical drugs);
- 3) Long-term construction projects of non-industrial real estate like hotels, office buildings, electric power and communication networks, etc.

This classification and the possibilities it implies may make the task of finding the relevant proxy look daunting, however, first, there are low-hanging fruits to consider. Private non-residential construction projects are the projects that are the most easily susceptible to the analysis in terms of ABCT because they have relatively clear points of initiation, use a common range of major, relatively standardized, tradable inputs

Normally, for developed economies, data are available for private non-residential construction (and equivalent) spending and (or) investment in non-residential construction. If this proxy shows signs of the ABCT-envisaged pattern, one may take it as a starting point, and look into the major components of construction spending, the most important of which are industrial

construction, commercial construction, and multi-family building construction. If several components show similar dynamics they may be aggregated into a single proxy.

If the evidence from nonresidential construction spending is inconclusive, it is possible to look at the data on non-residential structures investment and R&D by industry, and if a certain industry or industries show evidence of the ABCT-described pattern and their scale is significant, their investment into nonresidential structures or R&D or both or both plus investment into equipment if the projects in question passed the R&D stage, may be treated as a proxy.

The way to determine whether the malinvestment component is plausible as a proxy is to see what happens to this category of investment spending during the downturn. If it falls close to the level from which it started increasing during the boom or below that level, for instance, this is a strong indication that the increase in investment in nonresidential structures was of an artificial, clustered nature. The reason for this is that it is unlikely that during a normal process of innovation-related expansion, the investment into nonresidential structures will be so concentrated in time. The more pronounced and concentrated in time the investment boom is, the more likely it is that it was of an artificial nature.

When the increased competition for the contested goods is finally revealed, at least two scenarios may play out. Either the closer-to-consumption projects will be able to immediately start bidding away the contested goods from the excessively long projects - which will mean that the latter will have to be downsized or stopped entirely – or the undertakers of the excessively long projects will be able to carry through by attracting additional borrowed funds or by cutting expenses elsewhere in their business. In this case, some closer-to-consumption projects will have to reduce the scope of their activities.

In reality, the process will probably involve a combination of the two pure scenarios but in the aggregate, it will probably be either the aggregate spending on the closer-to-consumption projects or on the excessively long projects that will go down more, at least initially. The presence of one of the patterns described together with the previously mentioned empirical elements will be a strong indication that the boom and bust episode under analysis is explicable by ABCT.

It is possible, however, that the originators of the excessively long projects may decide to try to fully or partially complete them instead of abandoning them or putting them on hold until

the conditions improve. In such a case, the negative influence of the excessively long projects will tend to manifest itself not in the collapse in the related types of investment spending but in the collapse of other types of investment spending or other spending, as companies undertaking the excessively long projects will scramble for the necessary funding. Alternatively, those companies may reduce their expenses through cutting spending on other inputs, including labor. They also may do both of the aforementioned things simultaneously. The second of the three approaches seems to have been taken by MGM in the case study in the Preamble.

4.4 Identifying the corresponding cluster of troubled loans or other types of borrowing

As it was mentioned in the beginning of this chapter, finding a presumptive cluster of investment spending is not sufficient to consider it an instance of a cluster of excessively long projects. In order to qualify as such, the cluster should be financed via an identifiable cluster of loans created as a result of the central bank's loosening of monetary policy. Thus, at a minimum, a major increase in the amount of loans and (or) bond sales connected to the cluster of investment projects must take place after the monetary policy loosening. Preferably, it should also exhibit the following features:

- 1) The increase in delinquency with respect to the relevant loans or other borrowings preceding the open manifestation of the crisis. This is an important sign because it may indicate that the potentially excessively long projects started facing significant cost overruns, exactly as described by ABCT.
- 2) Significantly rising delinquency with respect to such loans or borrowings accompanying the full-blown crisis stage. Such rising delinquency may lead to bank failures if the affected banks have credit portfolios that are over-exposed to the relevant industry. If a large number of banks failed because of such over-exposure, it should suggest that the troubles faced by the relevant industry were significant enough to cause problems beyond it, and potentially, all or a large part of the relevant economic decline.

- 3) A significant decrease in the total amount of loans or borrowings outstanding for the relevant type of lending over the course of the bust stage of the crisis which points at the same phenomenon as (2).

Identifying other potential types of borrowing for financing candidate excessively long projects may be more challenging than identifying bank loans directly granted for facilitating such projects since publicly available information on, for instance, corporate bond issues or new equity purchased fully or partly using bank credit will not necessarily specify which projects the relevant funding is attracted to finance. And even though such information may be available in some individual cases, to the knowledge of this author, there are no publicly available statistical indicators tracking bond or equity funding allocated to long-term investment projects, let alone the portion of it that may be traced to bank loans.

4.5 Identifying the candidate contested goods

After both the cluster of troubled investment projects and one of the related loans and (or) other borrowings have been identified, the third crucial piece of the puzzle is the contested goods. As envisaged in chapter 2, the contested goods should be inputs that:

- 1) Are involved both in the undertaking of excessively long projects and the activities constituting the closer-to-consumption projects.
- 2) Exhibit a specific pattern of their market prices where the latter initially do not rise with the initiation of the excessively long projects or rise much less than later.

Needless to say, in order to be worth considering, the candidate contested goods must form a large part of the costs of undertaking the candidate excessively long projects, otherwise the impact of the rising prices of such goods may not be sufficient to create major difficulties for them, even if the price increases are very substantial. But before analyzing them in detail, it must be established that the behavior of their prices was unusual compared to other inputs during the boom and bust episode in question. For instance, their prices might be rising while the prices for most other inputs (the proxy of which may be the overall producer price index (PPI)) may be stagnant, falling or rising much more slowly.

As for the characteristic price pattern, the most important question that may arise is at what point we can say that the damaging price rise has started to occur. This is important, given that in the actual complex modern economies, we are unlikely to observe pure patterns in which the prices of inputs remain flat for some time after the candidate cluster of investment projects is launched, and then skyrocket. In addition, since credit expansions usually coincide with improving economic activity and hence use of inputs, and excessively long projects are unlikely to not use a major input at all before starting to heavily employ it, it is likely that some price appreciation may take place between the beginning of the cluster and the price-fueled discovery of the increased competition for the contested good not covered by the margins of error of the excessively long projects. While, admittedly, there may be no practical way to precisely answer the question where the damaging price increase starts,⁹⁰ several stylized facts, if present in an actual historical episode, may be helpful.

- 1) The price rise in question may coincide with a stage at which a large part of the candidate excessively long projects start using the relevant input much more intensively than before.
- 2) The price rise may coincide with the rising rate of delinquency for the cluster of excessively long projects-related borrowings.
- 3) The price increase may coincide with the closer-to-consumption projects increasing spending on the contested goods or (as a proxy) increasing spending or at least such spending stopping falling, while the spending of the excessively long projects continues to rise.

Finally, it bears mentioning here that in certain specific historical circumstances (for instance, during periods of large-scale across-the-board innovation), the price pattern for contested goods may conceivably differ dramatically from the characteristic pattern described here. If innovation is causing consistent input price declines, the errors behind excessively long projects may consist in wrong expectations of further price declines for the contested goods rather than a failure to foresee their rapid growth.

⁹⁰ In order to do it precisely, one would need to obtain the actual margins of error of the relevant projects and establish the point in time where a large part of them faced the need to make additional outlays above the margin of error because of the contested good price rise.

4.6 The signs of closer-to-consumption projects

The closer-to-consumption projects are an important piece in the puzzle because it is they that are generally supposed to inject more competition for the contested goods and lead to their prices rising, although it must be noted that in some cases their impact can be relatively more passive. For instance, if the spending on contested goods by the excessively long projects is heavily concentrated late in the process of their undertaking, closer-to-consumption projects may not have to try to increase production that initially decreases because the excessively long projects are boosting the demand enough for the closer-to-consumption projects to matter merely through not rapidly reducing their spending further.

To qualify as closer-to-consumption projects, the relevant economic activities should certainly be significant users of the contested goods. They should also initially be forced to decrease such use because of the increased demand from the excessively long projects. Afterwards, they should either attempt to boost such use in response to the rising consumer demand, and thus prices, for the relevant consumer goods or at least keep the use constant or decreasing slowly in the face of a rapidly rising demand from the excessively long projects if the latter is heavily concentrated in time, as mentioned above.

The identification of the candidate closer-to-consumption projects in the actual historical episodes, though, may be substantially more complicated than that of the candidate excessively long projects because it may not be easy to convincingly demonstrate that at some point they could be delivering more final consumer goods, were it not for the competition from the excessively long projects. The task may be simplified, however, if the closer-to-consumption projects mostly consist of continuous production activities.

4.7 Estimating the size of the boom and identifying the specific industries within the cluster

The final major issue in applying ABCT to historical episodes is the estimation of the impact of the potential malinvestment clusters on the overall economy. After all, the goal of research may not be to study any potentially interesting phenomena but, first and foremost, those that have significant consequences.

Estimating the size of the boom if all or some of its aforementioned elements were identified is not necessarily a straightforward task because it is not obvious that the whole increase in the relevant investment spending proxy over the boom period can be attributed to malinvestment, especially if the period under analysis involves genuine economic growth or recovery after a previous economic crisis.

As in the case of identifying the clusters of excessively long projects, however, there are potential low-hanging fruits. First, if a clear cluster of loans or other borrowings related to the potential excessively long projects has been established, it may be taken as a basis for calculating the approximate size of the boom. The most naïve approach that has to be followed if there is no way to estimate exactly what share of the relevant projects was financed by borrowing is to calculate the amount of loans or other borrowings that faced trouble beginning at the stage where the underlying projects presumably started facing difficulties because of the damaging contested good price increases. In order to do this, for instance, the increase in the percentage of nonperforming loans of the relevant kind may be used. Then, the aggregate total of such loans may be used as a plausible lower bound of the size of the boom with the additional adjustments depending on the given historical context.

Another possible approach to estimating the size of the boom, that may be used in conjunction with the loan (borrowings)-based one is to attempt to disaggregate the proxy investment indicator by industry.

If the data on investment in question by industry is available, they may be compared to the data on the industry sales. If the ratio of the relevant investment spending to sales is too low for an industry, it is unlikely, although not impossible, that certain projects in such an industry were part of an ABCT-described cluster of malinvestments because their scale may not be sufficient to materially affect the enterprises undertaking such projects, and cause them to either abandon or put on hold those projects or reduce other types of spending.

The industries for which the ratio is substantial may be aggregated, and the size of the boom may be estimated as the sum of the annual amounts by which the total annual amounts of the relevant investment over the potential ABCT-described boom period exceed the amount in the pre-boom year. The resulting estimate may plausibly be used as the upper bound of the boom size estimate, and the final estimate may be calculated as the average of the loans/borrowings-based estimate and the industry-breakdown-based one if both are available.

If these two approaches to estimation are not (easily) utilizable, the task certainly becomes considerably more difficult because one potentially then needs to attempt to pinpoint the actual major projects like CityCenter that were potentially part of the cluster and aggregate their total spending to arrive at the estimate.

4.8 Miscellaneous remarks on the application of the theory

It has to be noted that with respect to the approach discussed previously in this chapter that, while it should tick all the boxes, it does not have to proceed rigidly in the precise order outlined above. For instance, as will be demonstrated in the following chapter, the initial estimate of the size of the cluster of the candidate excessively long projects may be made on the basis of the category of loans that appears to have included excess credit and that may have fueled the cluster of excessively long projects. The initial estimate may be made in parallel with analyzing the relevant category of the loans.

The process of applying ABCT to a given historical episode may also identify other elements of interest that do not figure in the core pattern envisaged by the theory. For instance, this concerns the potential interactions of the excessively long project cluster with other developments in the local and global economy that were touched upon in section 2.6.

Finally, other potential explanations that do not involve ABCT that may explain the observed developments during a historical episode may also be considered, especially if they appear to be plausible alternatives to ABCT in the given case. An example of this in the following chapter is the discussion of the role of collateral posted by nonresidential construction projects

whose deterioration may potentially explain the difficulties they faced in the early stage of the U.S. Great Recession on its own.

5. ABCT and the U. S. Great Recession of 2007-09

In this chapter, the version of ABCT developed above will be applied to the latest boom-and-bust episode in the U.S. economy whose crisis stage is usually referred to as the Great Recession. However, before we proceed, it must be noted, that, as it should be clear from the preceding chapter, the framework of empirical analysis utilized here is complex and at a relatively early stage of development. It is complex particularly because it is mainly qualitative and thus requires establishing the presence of many elements in the historical episodes in question. This essentially means that in order to provide credible evidence that the theory applies to a given episode, several papers are needed that address narrower questions than whether the theory as a whole throws light on the case in question. Hence, the objective of this and the following chapter dealing with the U.S. Great Recession is relatively modest: it is merely to provide *prima facie* evidence of the ABCT-envisaged pattern justifying further research into the two historical episodes considered here. Where appropriate, the limitations of the current understanding will be noted and the avenues for further empirical research will be discussed in the concluding part of this volume.

In what follows, an attempt will be made to establish the elements of the ABCT pattern in the economic boom of the early 2000s and the initial stage of the subsequent decline. It will be shown that not only small-scale housing construction but also non-residential and equivalent construction underwent a significant boom during the early 2000s, after which investment spending on such projects crashed to the level below that from which it started. In addition, the corresponding cluster of loans that followed a similar trajectory is identified. In order to establish the particular industries affected by the boom, data on investment into non-residential structures by industry are analyzed. An attempt then is made to roughly estimate the volume of the projects affected by the boom and bust. Finally, the cost structure of non-residential construction projects is considered with a view to establishing the potential contested goods to then look into the dynamics of their prices. It is concluded that the intermediate goods that are plausible candidates in this regard are steel components and, potentially, flat glass. The U.S. steel market is briefly analyzed in order to establish whether the spike in steel prices in early 2008 could have been caused by the soaring demand from non-residential construction, or it is merely a local consequence of the global impact of the ascending Chinese economy and its demand for inputs such as steel.

5.1 Preliminary analysis of the boom and bust period

Determining the period for analysis is relatively straightforward for the run-up to the Great Recession since there was only one round of expansionary monetary policy undertaken by the U.S. Federal Reserve. It is also possible to relatively clearly establish the duration of the monetary stimulus provided by it.

Taylor (2009) is a reference of choice for the analysis of the monetary policy during the episode in question because Taylor authored the widely acclaimed interest-rate target rule to guide monetary policy-making. With regard to the run-up to the U.S. Great Recession, Taylor's analysis (Fig. 9) suggests that the U.S. Federal Reserve maintained the target interest rate – the Federal funds rate – at a level that was too low compared to the Taylor rule-conforming counterfactual during the period between 2002 and early 2006.

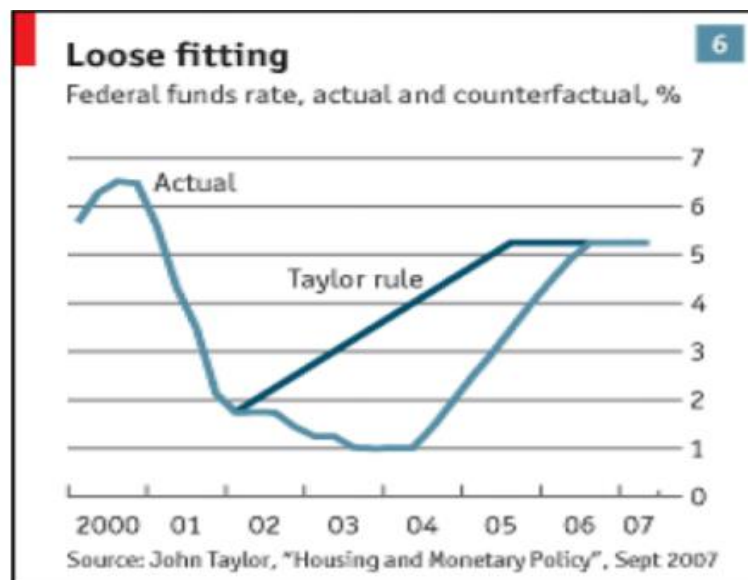


Fig. 9. Federal funds rate vs the Taylor rule.⁹¹

Hence, any cluster of loans that may have been allocated to the potential excessively long projects should have been made within this period. The next section deals with the most prominent

⁹¹ Taylor 2009, p. 3.

part of the credit boom that accompanied the credit expansion implied by this deviation – the mortgage lending boom that fueled a boom in 1-4-family housing construction.

The case in favor of the presence of credit expansion during this period is bolstered by the data on the money supply and total loans and leases in the banking system. Fig. 10 and 11 below plot the respective indicators from 1990 to present.

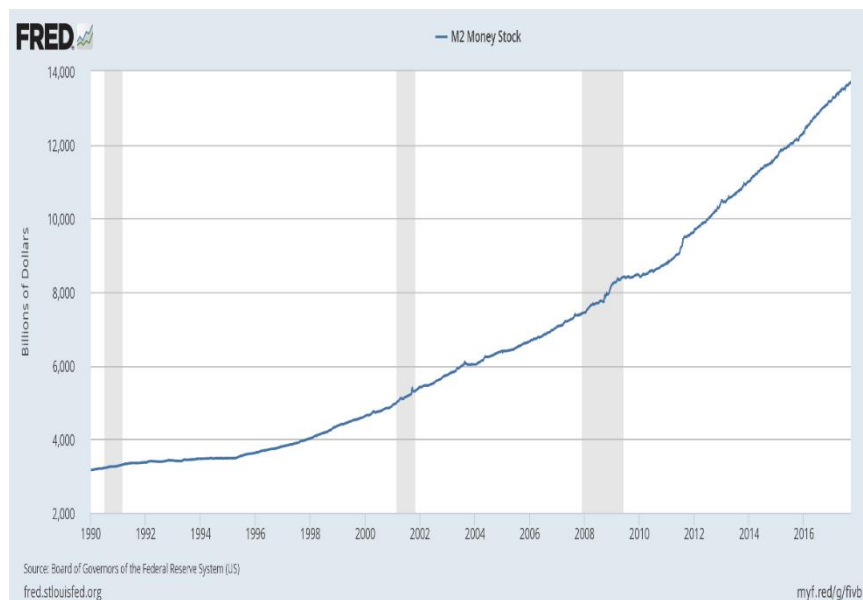


Figure 10. U.S. M2 money stock (US\$ billion). Source: Board of Governors of the Federal Reserve System

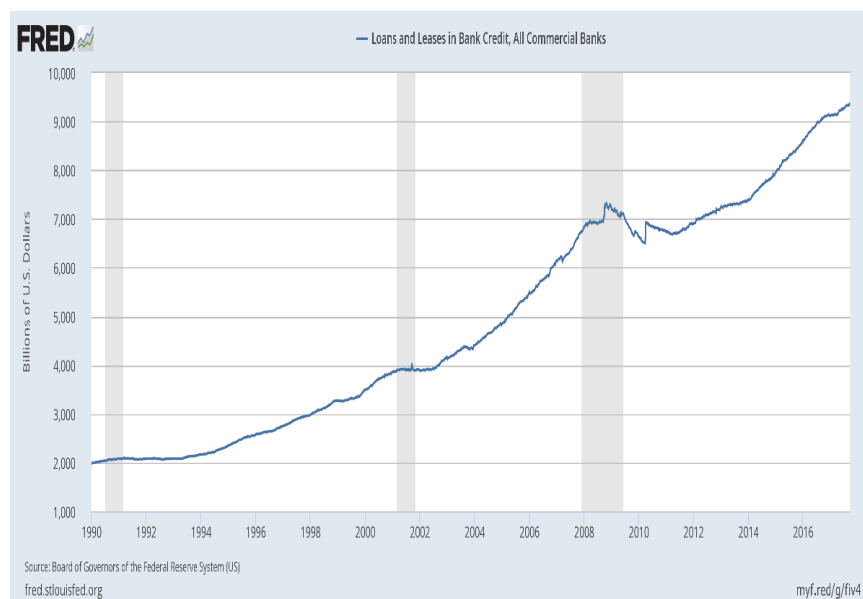


Figure 11. Loans and leases in U.S. bank credit (US\$ billion). Source: Board of Governors of the Federal Reserve System

An immediate objection that may be made to the ABCT-based interpretation of the credit-expansion-based explanation of the Great Recession is that during the 2000s the total amount of credit has increased slower in relative terms than in the 1990s, whereas the Great Recession was a much more serious economic downturn than the post-1990s dot-com recession. However, one has to note that the bulk of credit growth during the 2000s took place much faster than in the 1990s, which implies that the credit expansion may well have caused a larger misallocation. Another important observation is that the GDP growth was higher in the 1990s than in the 2000s, which may well have neutralized some of the negative effects of the credit expansion.

Finally, according to the methodology proposed in the preceding chapter, the preliminary analysis of a boom and bust episode should include a category of bank loans that are clearly showing a boom-and-bust pattern and that are allocated to relatively lengthy investment projects. Our task with regard to the 2000s is made substantially simpler by the fact that a standard category of loans tracked by the Federal Deposit Insurance Corporation satisfies both of the aforementioned criteria quite well (Fig. 12), namely acquisition, development and construction (ADC) loans.

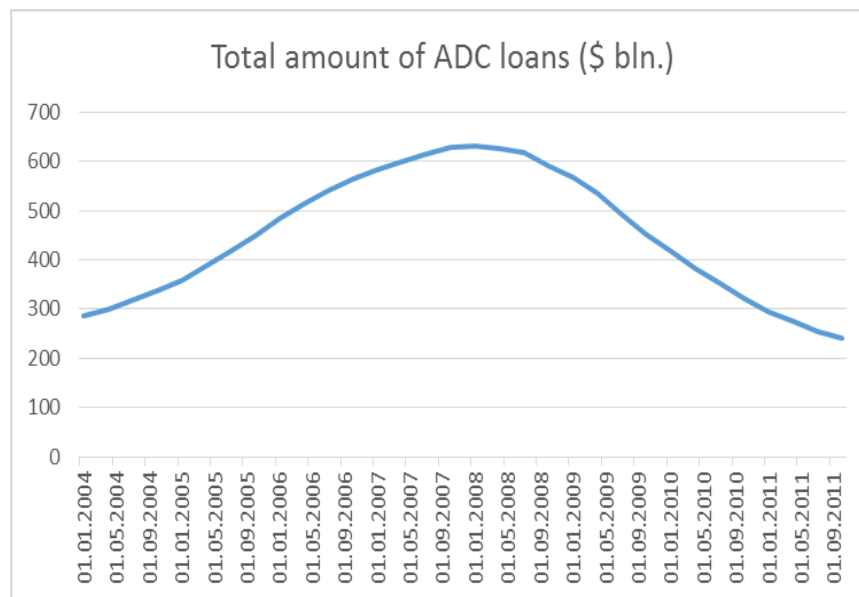


Fig. 12. The total amount of ADC loans outstanding (US\$ billion). Source: FDIC Quarterly Banking Profile

It is obvious why ADC loans qualify as credits allocated to relatively long investment projects as they are by definition granted to residential and non-residential construction projects starting from the construction site acquisition stage. As the chart above makes clear, this category of loans underwent a pronounced boom-and-bust dynamic during the 2000s. Further below, the evolution of these loans will be analyzed in more detail but before we proceed, an obvious question must be asked why the candidate loans discussed in this section do not include the loans that are popularly associated with the Great Recession, namely, the housing mortgages, especially their less-than-prime subset.

5.2 Could housing construction and the housing mortgage boom have constituted the cluster of excessively long projects?

Perhaps, the most popular account of the latest business cycle episode in the US economy is that the financial crisis and the subsequent recession were caused by the preceding boom in the sector of 1-4-family housing financed largely by less-than-prime mortgage loans and the related stock-market boom, especially in the mortgage-backed securities (created by means of securitization), as well as the financial instruments derivative from them (like collateralized debt obligations, or CDOs).

This view of the crisis is somewhat surprisingly shared by both the proponents of the idea that the crisis originated in the over-optimism or some other decision-making flaws of the market participants (e.g. Shiller (2008), Geanakoplos (2010)) and those who attributed it to the government intervention (e.g. Taylor (2009), Friedman (2009), Schwartz (2009)). Among the latter, were even some economists of the Austrian school (e.g. Boettke and Horwitz (2009), Horwitz (2009), Woods (2009), Salerno (2012), Ravier and Lewin (2012), Fillieule (2013), Koppl (2014)).

Fig. 13 deals with total private residential construction spending, however, since the bulk of such lending was constituted by 1-4-family housing, we can use this figure as a proxy. It is clear that residential construction spending started accelerating compared to the preceding trend in late

2003, which is well within the period during which monetary policy was too loose, according to the Taylor rule.

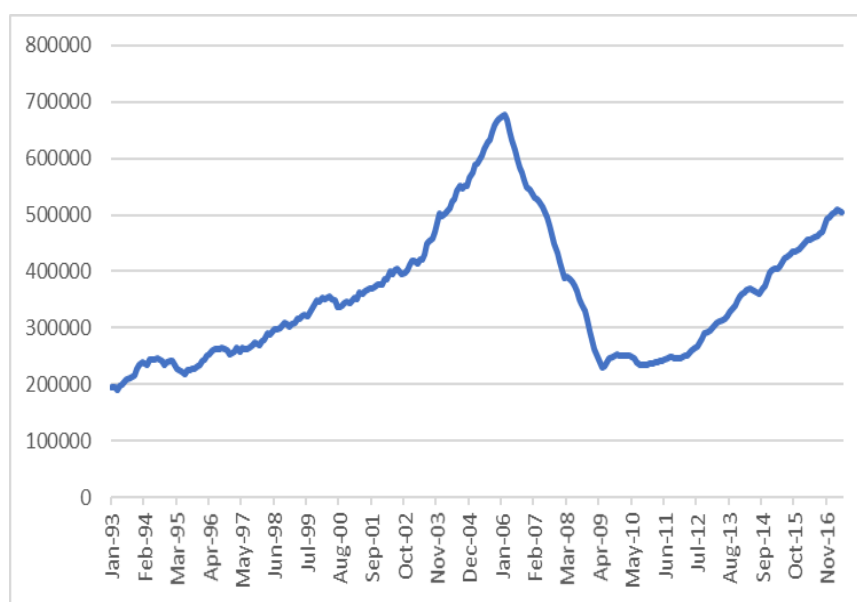


Fig. 13. U.S. Bureau of the Census, Total Private Construction Spending (US\$ million): Residential [PRRESCONS], seasonally adjusted annual rate, retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/PRRESCONS>

It is outside of the scope of this work to attempt to evaluate the hypothesis that the housing boom and (or) its financial-market ramifications were a major cause of the subsequent recession, although one has to note that, before the recession officially started in 2007, housing construction spending had already completed most of its downfall. It will also be noted below that mortgage lending to 1-4-family housing actually declined less in absolute terms during the Great Recession than the acquisition, development and construction lending, which suggests that any direct credit crunch effect from the mortgage crisis was relatively limited.

However, what is essential to address here is the idea that 1-4-family housing construction projects may have been the kind of malinvestments that ABCT is concerned with. The basic reason why this hypothesis is untenable is that investment projects for building the 1-4 family units in question generally just do not take a sufficient amount of time.⁹² Multifamily building construction

⁹²For instance, Siniavskaia (2013) estimates that it takes on average 5-6 months to build a single-family house in the US. Clearly, the construction projects with respect to such housing do not qualify as the excessively long projects that should have failed if the recession of 2008 was an instance of the boom and bust process discussed here.

is an obvious exception here, however, as it constituted only 4% of private construction in 2007 according to Garner (2008, 91), we may avoid discussing it separately in detail given the scope limitations of this work.

Therefore, if 1-4-family housing were the only potential locus of the crisis-preceding boom, we would have to rule out ABCT as an explanation of what happened. However, there is another closely related sphere of economic activity which has been largely and probably wrongly neglected by most commentators and also underwent a boom and bust during the period between 2002 and 2009.

Nevertheless, a question may still be asked what the value is of considering 1-4-family housing construction and non-residential construction separately, given that the overexpansion of the former may well have resulted from government interference (particularly the Federal Reserve's loose monetary policy) with market mechanisms and has probably had similar consequences in terms of misallocating capital, labor, and entrepreneurship, as well as creating a cluster of bad loans. The response is twofold. First, each of the two respective misallocation patterns has its own independent mechanism and may potentially take place separately in the case of a credit expansion depending on where the excess credit is channeled and whether additional factors like the policies of Fanny Mae and Freddie Mac are present. Secondly, the consequences of an ABCT-described construction boom may actually be somewhat different from those of a subsidy-induced housing expansion since in the former case it is companies not specializing in construction that can be burdened with troubled investment projects. Hence, in addition to misallocated resources, such firms may respond to the crisis by attempting – as MGM did with the CityCenter project - to complete the relevant projects anyway by slashing some other spending. The avenues for future research in terms of tracing the effects of the boom at the crisis stage will be discussed in more detail in the concluding part of this volume.

5.3 Private non-residential construction projects as excessively long projects

As discussed in the preceding chapter, while it may be challenging to determine the proxy for the cluster of potential excessively long projects, a given historical episode may contain a low-

hanging fruit in the form of a boom and bust pattern in private investment into non-residential construction. The U. S. Bureau of the Census publishes monthly data on private non-residential construction spending starting from 1993 (see Fig. 14 below). Private non-residential construction spending here includes both the industrial and the non-industrial component. Fortunately for the purposes of this work, the data indicate the presence of the low-hanging fruit, indeed.

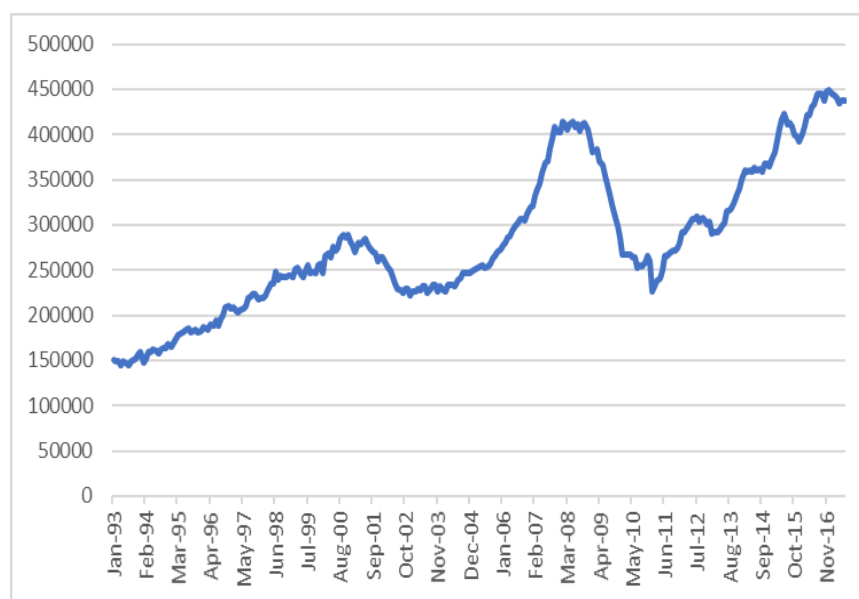


Fig. 14. U.S. Bureau of the Census, Total Private Construction Spending (US\$ million): Nonresidential [PNRESCONS], retrieved from FRED, Federal Reserve Bank of St. Louis;
<https://fred.stlouisfed.org/series/PNRESCONS>.

The graph seems to demonstrate that between July 2005 and October 2008 annualized monthly spending on private nonresidential construction grew from around \$257.6 to \$412.7 bln, thus soaring by 60.2% in a bit more than three years. Then, by early 2011, it had fallen all the way roughly to the level from which its growth had originally started. While it is certain that not all of this additional spending involved new long-term projects, it can be reasonably assumed that much of the dynamics was driven by them, since it is implausible that there was a sudden spike in maintenance and repair needs of the existing structures.

What also deserves to be noted is the contrast between the depth of the decline in spending associated with the Great Recession and the one associated with the dot-com recession. During the boom period of the 2000s, this spending both rose much higher in absolute terms and more rapidly, and fell much lower during the subsequent economic crisis. The character of fluctuations in the

2000s episode seems to suggest that the relevant sectors played a role in the course of the business cycle, while during the dot-com episode the fluctuations in long-term construction spending may well have been merely symptomatic.

In addition to this, the post-Great Recession recovery in private nonresidential construction spending has only regained the level such spending had reached at the 2008 peak in 2015. This is a strong, although not absolute, indication that the level reached in 2008 was artificial and unsustainable at the time, or, in other words, that much of the non-residential construction spending in 2005-08 constituted malinvestments. The most plausible potential objection may come from observing that the 2008 peak was roughly what would have been expected if private non-residential construction kept growing at the rate it was growing in the run-up to the dot-com recession. However, this assumes that there were no malinvestments into private non-residential construction in that period, which is far from straightforward, given that the relevant spending declined sharply in 2001, even if the decline was not as dramatic and prolonged as it was during the Great Recession and its aftermath. Future research may resolve this issue by looking, for instance, at whether the growth in private non-residential construction spending was concentrated in the same industries prior to 2001 as in the pre-Great-Recession boom.

It deserves pointing out that the distinction between nonresidential and residential construction projects made here is not absolute. While the bulk of the residential buildings built over the period of the boom were 1-4 family units,⁹³ the multifamily building construction projects undertaken during the period under consideration are not qualitatively different from nonresidential ones because, like the latter, they do not result in the delivery of consumer goods or services and may trap capital.

The hypothesis that private non-residential construction projects underwent an unsustainable, artificial boom is further supported by a seemingly related cluster of bank loans that followed a similar trajectory during the period in question.

⁹³ Garner 2008, p. 91.

5.4 The cluster of acquisition, development and construction loans analysis and the initial malinvestment boom size estimate

After establishing the candidate locus of the excessively long project cluster, the next step in the application of ABCT to the Great Recession is to identify the roughly corresponding cluster of bank loans and verify that the loans constituting it probably faced significant repayment problems during the period under analysis. It was already mentioned in section 5.1 that ADC loans are a good candidate for just such a loan cluster, hence in this section, their dynamics will be studied in more detail.⁹⁴

To start with, it should be noted that, according to Dietz (2017), around two-thirds of ADC loans during the 2000s involved nonresidential or multi-family building construction projects by 2008, and the remaining ones were used for financing 1-4-family residential ones. As mentioned above, since there is no qualitative difference between failed long-term residential and nonresidential projects for the purposes of my study, therefore this work will analyze the behavior of the large-scale ADC loans in the aggregate, and hereinafter, the term ‘nonresidential construction’ will also include reference to multifamily building construction.⁹⁵

The evolution of ADC loans between 2004, when their amount started to grow significantly, and their nadir in 2011 is depicted in Fig. 15 below. Their dynamics demonstrate a rather plausible connection to the monetary expansion undertaken by the Federal Reserve in that their explosion started during the time when target interest rates were held too low.

⁹⁴ For the sake of tractability, this chapter will be limited to the analysis of ADC loans, even though it is quite probable that they were not the only source of debt financing for the candidate excessively long projects. For instance, the CityCenter project discussed in the Preamble was financed by a revolving loan that does not appear to qualify as an ADC loan.

⁹⁵ As mentioned below, however, the overall significance of multifamily construction spending during the period was not high.

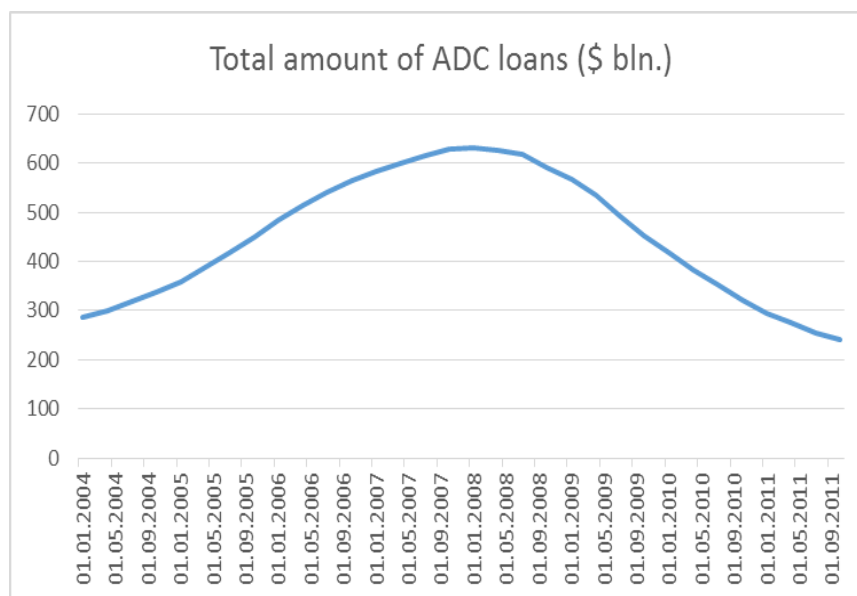


Fig. 15. The total amount of ADC loans (US\$ billion). Source: Federal Deposit Insurance Corporation (FDIC) Quarterly Banking Profile

The fact that the total amount of such loans soared more than twofold in a short period of time is a strong piece of evidence implicating the loose monetary policy of the Federal Reserve in fueling the long-term construction boom. However, the subsequent collapse of the amount of such loans outstanding is not in itself clearly indicative of this. The dynamics of delinquency, however, highly reinforces the ABCT-based explanation.

The FDIC's data distinguish among three categories of troubled loans: loans 30-89 days past due, noncurrent loans (due past 90 days or longer) and charged-off loans (loans that banks recognized as unlikely to be recovered). According to the FDIC data plotted in Fig. 16, the share of total troubled ADC loans started growing significantly in 2007, although it may have been the case that with the rapidly growing total amount of ADC loans there were some loans that were intrinsically bad, irrespective of the ABCT-described mechanism and that it is such loans that started going sour in 2007. However, the growth of such share that started in late 2007, and especially in early 2008 is so far beyond the preceding period that a systemic explanation is in order.

The share of troubled ADC loans was 18% even at the end of 2011. This strongly suggests that some of the underlying projects started facing difficulty already in late 2007. However, there are reasons to believe that the projects in question were mostly multifamily and 1-4-family

residential ones which are not studied in detail in this chapter. The main reason for this is that residential ADC loans tend to be of a shorter duration, hence if most of them were made in 2005, their term had been over by early 2008, probably too early to be part of the boom that is the subject of this chapter. This conclusion is bolstered by the fact according to Dietz (2017), the total of 1-4-family residential ADC loans did not grow significantly in 2007 and started to decline in early 2008. Hence, it is probably reasonable to infer that by the early- or mid-2008, it was probably increasingly nonresidential ADC loans that were facing repayment difficulties.

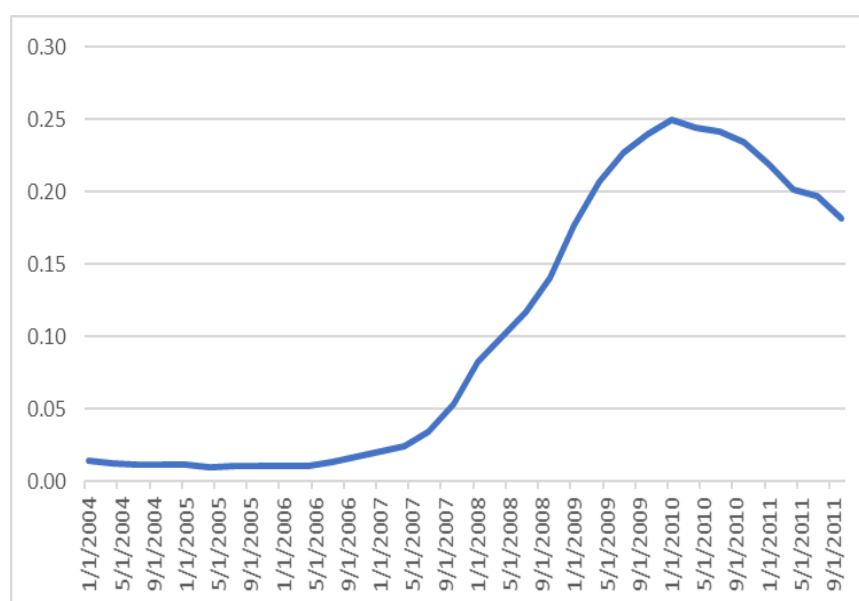


Fig. 16. The share of troubled ADC loans. Source: FDIC Quarterly Banking Profile

Perhaps more important than the data on the share of the troubled ADC loans is the total amount of such loans. This evolution of this indicator (Fig. 17) reveals that already before the financial crisis struck at full force in October 2008, by the end of the third quarter, ADC loans totaling \$62.34 bln. had been troubled. This amount rose to \$100.23 bln. by the end of the first quarter of 2009, and \$111 bln. by the end of the second quarter, where it roughly stabilized (the maximum it reached was \$111.58 bln. in the third quarter of 2009) and then started falling.

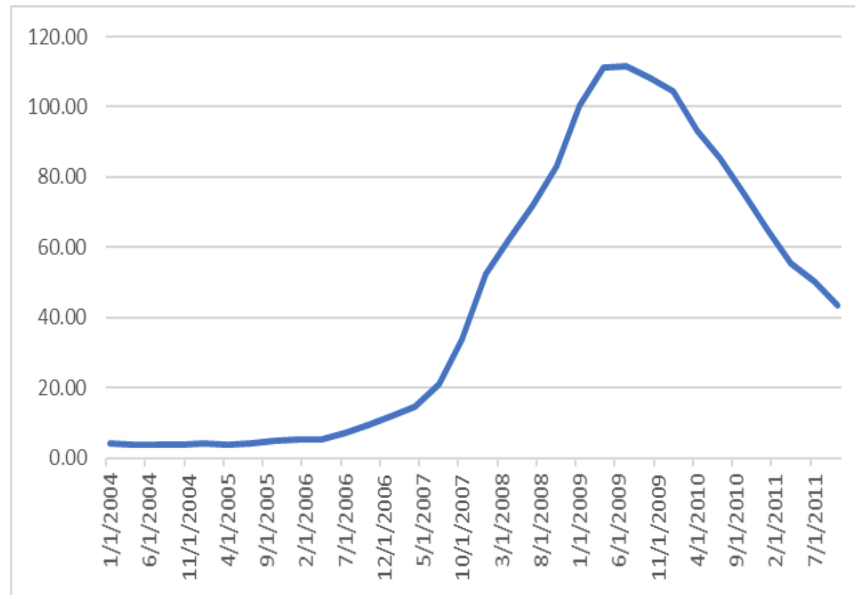


Fig. 17. The total amount of troubled ADC loans (US\$ billion), source: FDIC Quarterly Banking Profile

It is instructive to add to this the data on the value of real estate owned by banks (Fig. 18), presumably as a result of taking over the collateral under the troubled ADC loans. This figure also already started rising in 2007 but underwent most of its growth over the course of 2009. Given that banks are usually very reluctant to take over real estate, and that the total amount was rising, despite the falling real estate prices suggests that there was a substantial cluster of nonresidential construction projects whose loan repayment difficulties were very significant and often insurmountable.

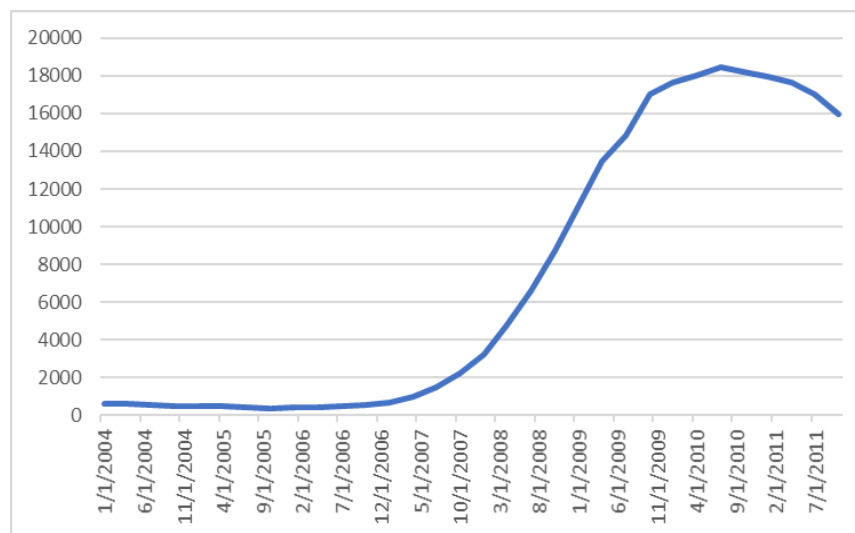


Fig. 18. Value of real estate owned by banks (US\$ million). Source: FDIC Quarterly Banking Profile

Before we move to the most important implications of the ADC loan evidence, it is important to note two detrimental consequences of their cluster that are not directly related to the misallocation caused by the potential excessively long projects. First, the surge in ADC loan delinquency led to substantial problems for the over-exposed banks. According to a study by FDIC,⁹⁶ 214 FDIC-supervised banks that had the concentrations of ADC loans of 100% of their capital or higher failed in the US from January 2007 to March 2011. More generally, the report suggests that, as may be expected, loans of different types tend not to be evenly distributed among banks. Hence, if a certain category of bank loans is disproportionately affected, this may lead to a large number of banks being unable to replace the existing loans with new ones. At the same time, the regulatory environment in the banking sector may make it difficult and costly to create new banks or for the existing banks to quickly compensate for the banks that are overexposed to certain types of loans. According to the study,⁹⁷ ADC loans in the run-up to the Great Recession were especially concentrated in de novo banks, small community banks and certain regions, especially those affected by the housing boom. Nonperforming ADC loans may have substantially contributed to the credit crunch that developed during the Great Recession not just through the direct misallocation of resources that the corresponding investment projects involved, perhaps especially where banks were exposed both to the housing loans and nonresidential ADC loans at the same time.

In addition, the troubles with ADC loans coincided with an enormous decline in the total amount of ADC loans outstanding. From December 2007 to December 2011 their total amount fell from \$629 bln. to \$240 bln., i.e. by 2,62 times. For comparison, over the same period, the total amount of loans secured by 1-4 family housing fell only from \$2245,3 bln. to \$1878 bln. This finding is perhaps the most surprising. Even in absolute terms the total amount of ADC loans outstanding fell more than that of the loans secured by 1-4 family housing. This may also have had an impact on the overall credit situation in the U.S. economy.

Finally, the ADC loan evidence discussed above allows us to make a preliminary estimate of the magnitude of the excessively long project cluster (in the narrow sense of excessively long projects, in according with chapter 2). As was mentioned above, the total amount of non-

⁹⁶ FDIC 2012, p. 2.

⁹⁷ FDIC 2012, p. 4.

performing ADC loans reached \$111.58 bln. in the third quarter of 2009. If we recall that two-thirds of ADC loans were for nonresidential purposes the resulting figure for nonresidential ADC loans is \$73.6 bln. The assumptions that go into this estimate are of course of a very approximative nature, and there are reasons to believe that this figure is both an overestimate and an underestimate.

As is discussed further below, some nonresidential construction projects during the period may have struggled merely because of the declining value of their collateral because of the perceived worsening economic prospects, especially for commercial real estate such as office buildings and hotels. The deteriorating value of the collateral may have triggered contractual interest rate increases. However, this mechanism is not necessarily mutually exclusive with the one envisaged by ABCT, and where it is not, it represents another instance of a detrimental interaction between the ABCT-described boom and other detrimental economic processes. In addition to this, some of the non-residential construction projects may just have been poorly designed.

As for the potential underestimation, the \$73.6 bln. estimate does not capture the projects whose originators, like MGM with CityCenter, tightened their belts to stick to them by reducing spending on other activities. Secondly, given the shorter duration of the residential ADC loans and that the housing boom already went bust in 2006, the fact that the share of noncurrent ADC loans started soaring in the late 2007 – early 2008 suggests that non-residential ADC loans made up more than two-thirds of the total of the non-current ADC loans. In addition to this, some nonresidential ADC loans may have been originated substantially later than in the beginning of 2005, while some loans may have been fully repaid or defaulted upon early in the crisis stage, meaning that the aggregate figures may well underestimate the total amount of ADC loans that went sour. Finally, lending to nonresidential construction may not have been limited to ADC loans. The 2005-2009 period also saw growth in the loans secured by the nonresidential non-farm real estate that were not ADC loans. The share of those loans that became noncurrent was much lower than for ADC loans but this category may still have accounted for some of the potential excessively long non-residential construction projects.

However, since this work is only a preliminary foray into the application of ABCT to the U.S. Great Recession, and given that there are reasons to consider the ADC loan-based estimate

of the size of the bubble to be both an under- and most likely an overestimate, we shall stick to the \$73.6 bln. figure. In line with the methodology sketched in the preceding chapter, this estimate will be used as the lower bound on the estimated size of the boom. We will return to the issue of estimating the size of the excessively long project cluster, as well as its impact on the wider economy in section 5.9.

5.5 Inputs into non-residential construction and the contested goods

5.5.1 Overview of the overall input and construction component prices

The next stage in applying ABCT to a particular historical episode consists in identifying the potential contested goods. There are many inputs that go into long-term construction projects that are also used by other industries, including shorter-term construction (for instance, lumber and concrete).

Before we start analyzing the price dynamics for particular inputs, as it is indispensable to attempt to establish the potential contested goods, it is important to consider the evolution of the commodity prices and all construction components over the period under consideration in general. The graph below (Fig. 19) plots the PPIs for all commodities and construction materials and components.

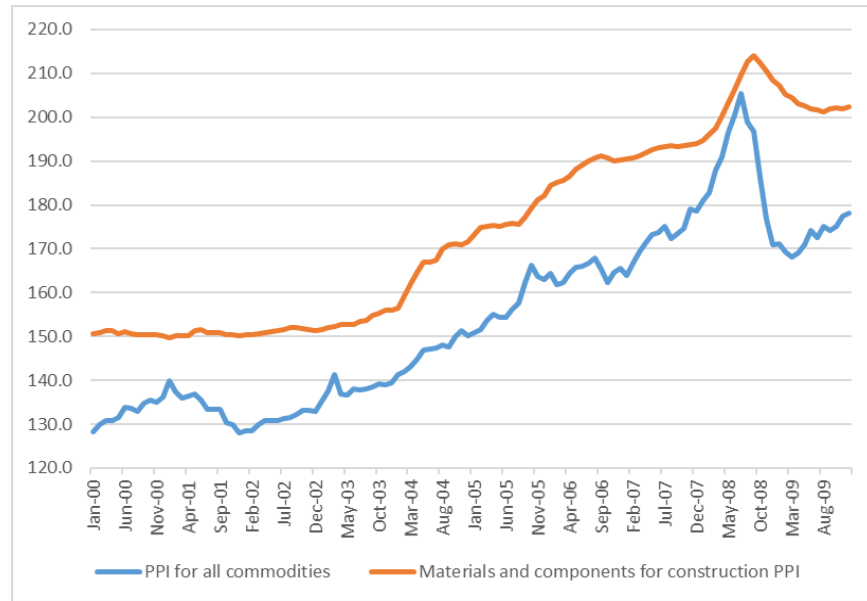


Fig. 19. PPIs for all commodities and materials and components for construction. Bureau of Labor Statistics data series PPIACO and WPSID612

It is clear that after the recovery from the dot-com recession that started in 2002, both commodities on average and construction components appreciated significantly, which raises the question whether the rise in construction costs is merely a part of a larger phenomenon of resource-hungry global economic growth led by China rather than a reflection of an ABCT-described boom. It is certainly impossible to answer this question based on just one graph, and it is quite probable that the global commodity boom contributed to a degree to the cost increases that construction projects in the U.S. faced at the time. However, what bears mentioning is that while the PPI for all commodities seems to have had a more or less uniform upward trend until late 2005, then a lull and then a sharp increase driven probably to the largest extent by oil prices, the evolution of construction components PPI seems to be at first sight better explicable with reference to the two overlapping construction booms that unfolded between late 2003 and late 2008. When housing construction started struggling in 2006, construction components PPI became almost flat, until early 2008, or precisely when private non-residential construction spending skyrocketed as can be seen in Fig. 14 above. This suggests that the boom in non-residential construction was significant enough to first offset the depressive effect of the decline in housing construction on the overall construction inputs PPI, and then overpower it. Given that the mix of inputs utilized in non-residential construction is somewhat different from that used in housing construction (long-term

construction utilizes proportionately much less lumber and more steel, for example), this suggests that the non-residential construction boom caused rapid appreciation in prices of certain particular inputs when it reached its most intense stage.

Modern non-residential construction involves the use of many different inputs but those that appear to be the most costly are labor, steel components, aluminum components, concrete, construction sand, gravel and crushed stone, drywall, paints and coatings, energy and labor. Concrete and steel products are mainly used for the foundations and carcasses of buildings. Float glass is used for windows and glass walls. Drywall which is the most widely used gypsum product is used for making nonessential internal walls. Aluminum can be used as a substitute for steel in building carcasses but is more popular in the exterior wall frames.

A. Labor

If we look at the trajectory of labor costs for construction over the period 2000-2009 period (Fig. 20), it is clear that, while they were growing continuously, there was a point in early 2005 where they accelerated. From the first quarter of 2004 to the first quarter of 2005, they grew by 6.7%, while the figure was 13% for the first quarter of 2006 compared to 2005. Then, unit labor costs added 10.7% by the first quarter of 2007 and 8.1% by the first quarter of 2008.

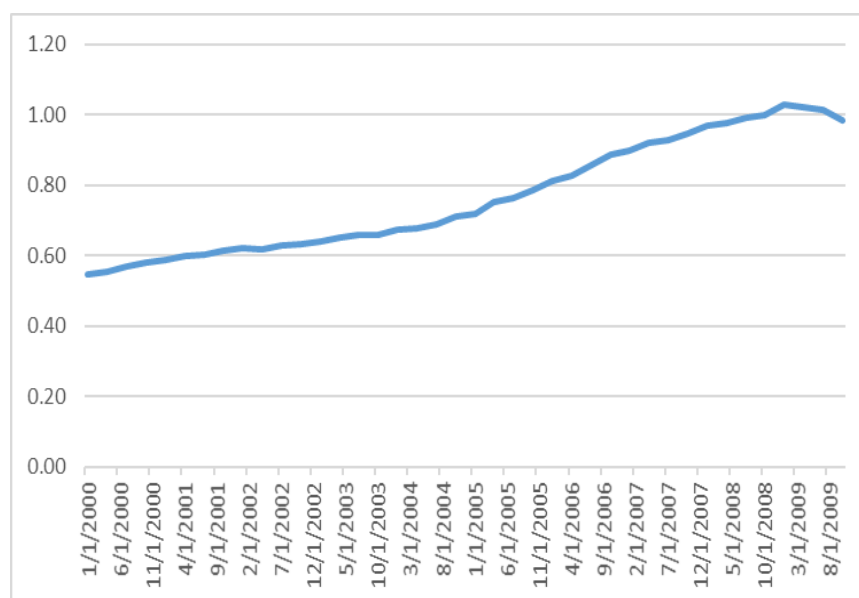


Fig. 20. Organization for Economic Co-operation and Development, Benchmarked Unit Labor Costs - Construction for the United States© [ULQBBU04USQ661S], quarterly, seasonally adjusted, retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/ULQBBU04USQ661S>

Added to the consideration that labor in non-residential construction is relatively specialized and thus mostly not contested by other industries in the short term, the evolution of unit construction costs suggest that labor probably was not a contested good during the run-up to the great recession because the rapid appreciation of labor costs did not happen with a lag compared to the launching of the presumable cluster of excessively long non-residential construction projects. The fact that rapid growth in this construction cost component happened early does not necessarily prejudice the applicability of ABCT to the Great Recession since for many projects these costs may have been within the margin of error but the appreciation in the contested goods may have been the last drop.

B. Concrete

As far as the evolution of concrete prices (Fig. 21) is concerned, it does not seem to fit the contested good pattern, either, since it demonstrates relatively uniform growth between 2003 and 2008. However, it does add to the seriousness of the caveat about the potential excessively long projects facing substantial cost increases early on.

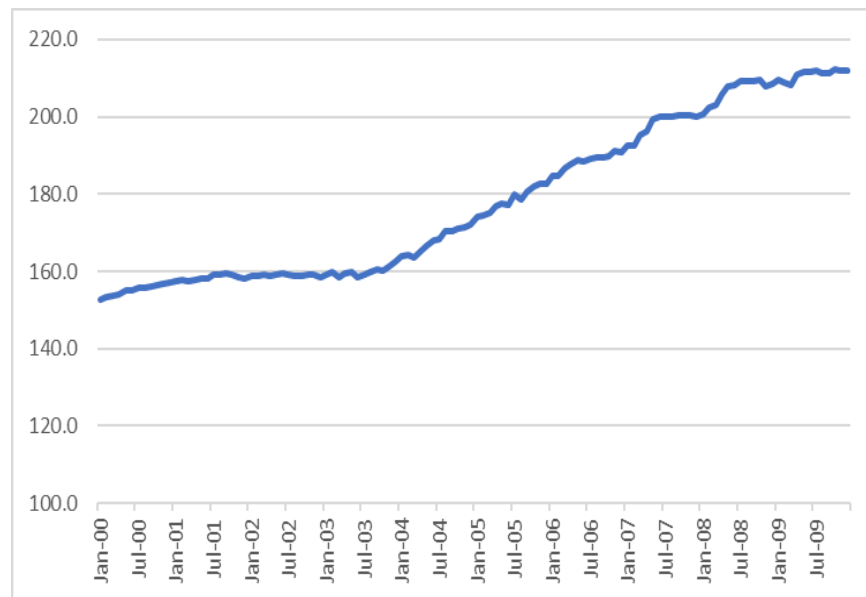


Fig. 21. U.S. Bureau of Labor Statistics, Producer Price Index by Industry: Other Concrete Product Manufacturing: Precast Concrete Slabs and Tile, Roof and Floor Units [PCU32739032739011], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/PCU32739032739011>

C. Construction sand, gravel and crushed stone, paints and coatings, aluminum components and energy

Roughly the same conclusions and caveat as with regard to concrete can also be made if the PPI for construction sand, gravel and crushed stone (Fig. 22), paints and coatings (Fig. 23), aluminum (Fig. 24) and energy (approximated by the PPI for industrial electric power, Fig. 25). The mechanism here is the same as with regard to concrete since all those inputs are used heavily in both housing and non-residential construction (aluminum especially in pre-fabricated aluminum buildings). The evolution of aluminum mill shapes PPI is somewhat different from that of the other in that the growth trend it shows is somewhat less uniform but the key point that its appreciation did not happen with a lag with regard to the launching of the cluster of potentially excessively long non-residential construction projects still applies.

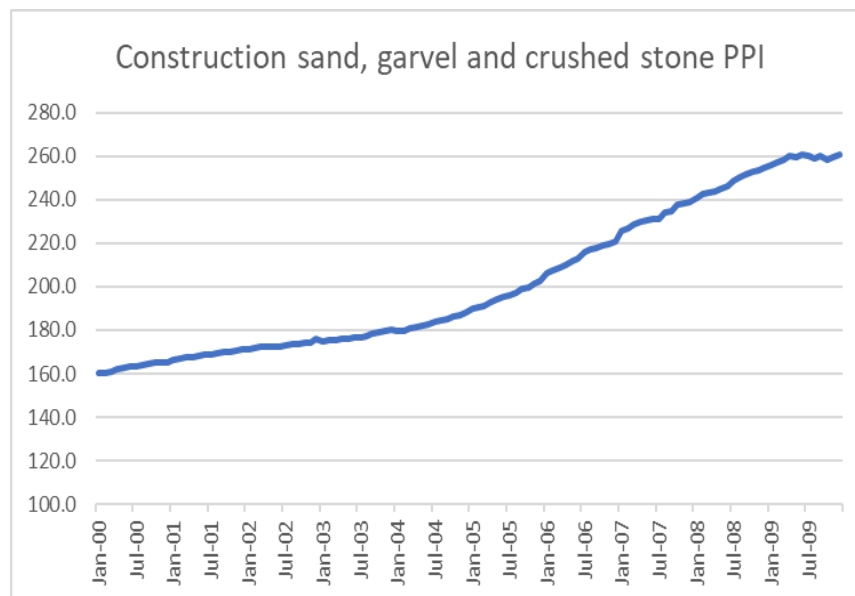


Fig. 22. U.S. Bureau of Labor Statistics, Producer Price Index by Commodity for Nonmetallic Mineral Products: Construction Sand, Gravel, and Crushed Stone [WPS1321], seasonally adjusted, retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/WPS1321>

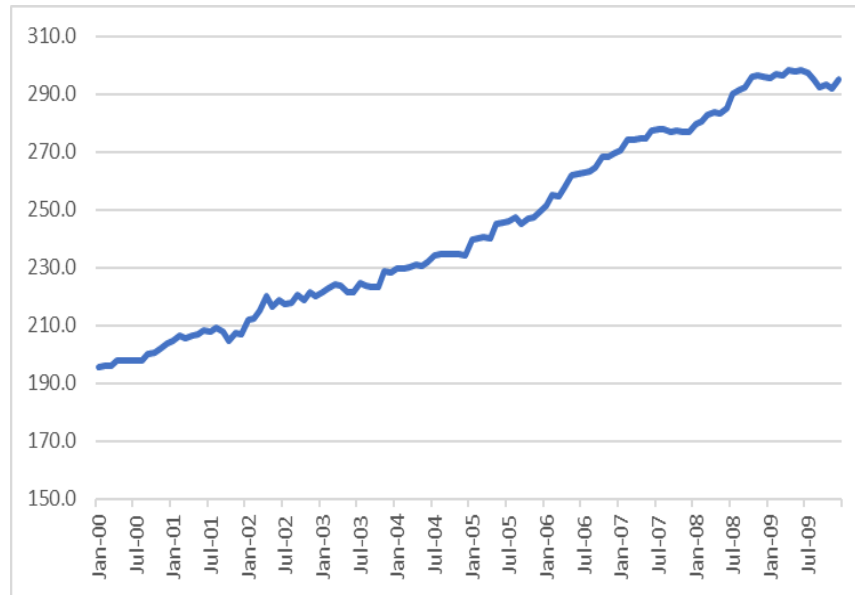


Fig. 23. U.S. Bureau of Labor Statistics, Producer Price Index by Commodity for Chemicals and Allied Products: Special Purpose Coatings, Including Marine, Industrial and Construction Coatings [WPU06210301], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/WPU06210301>

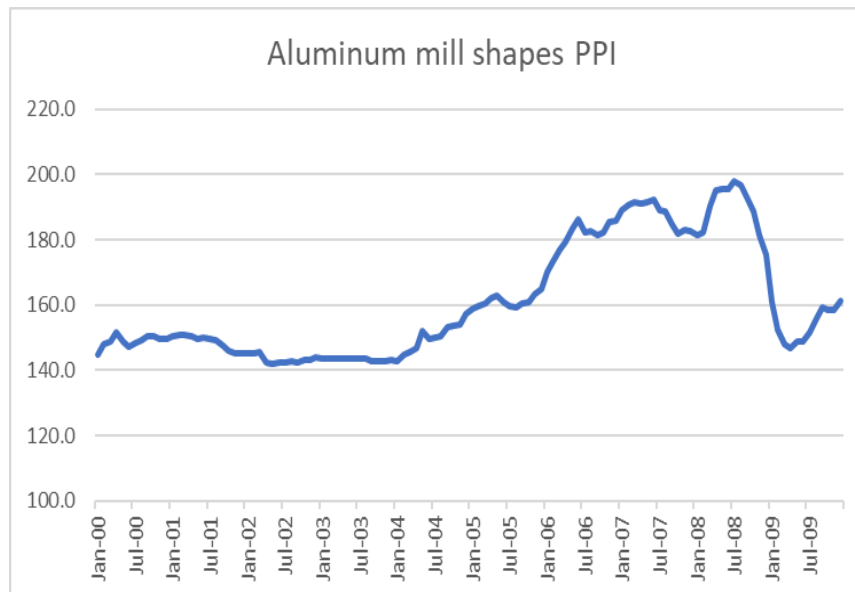


Fig. 24. U.S. Bureau of Labor Statistics, Producer Price Index by Commodity for Metals and Metal Products: Aluminum Mill Shapes [WPU102501], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/WPU102501>

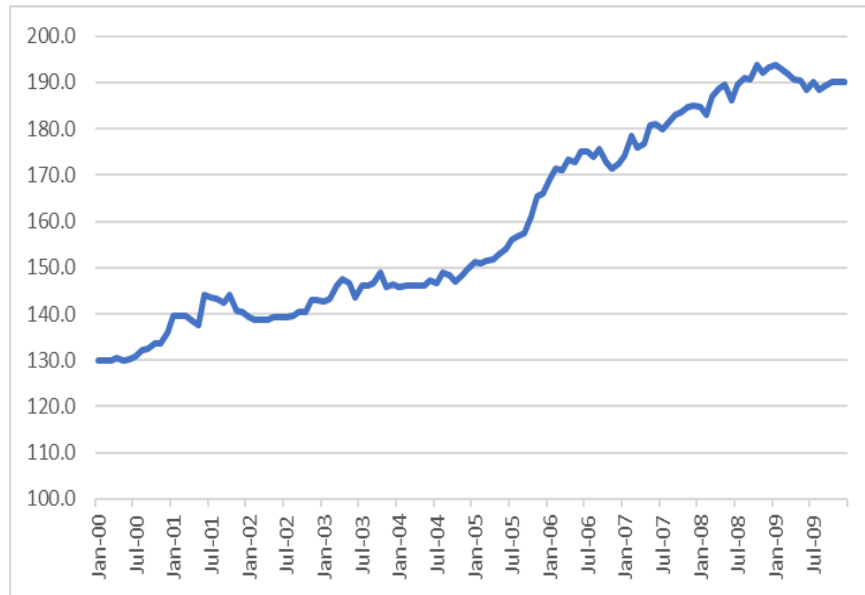


Fig. 25. U.S. Bureau of Labor Statistics, Producer Price Index by Commodity for Fuels and Related Products and Power: Industrial Electric Power [WPS0543], retrieved from FRED, Federal Reserve Bank of St. Louis;
<https://fred.stlouisfed.org/series/WPS0543>

D. Flat glass

Flat glass appears to be an input into non-residential construction that, given the dynamics of its PPI (Fig. 26) may have been a contested good but whose appreciation is not sufficient in its own right, since its price jumped in mid-2008 only by less than 10%.

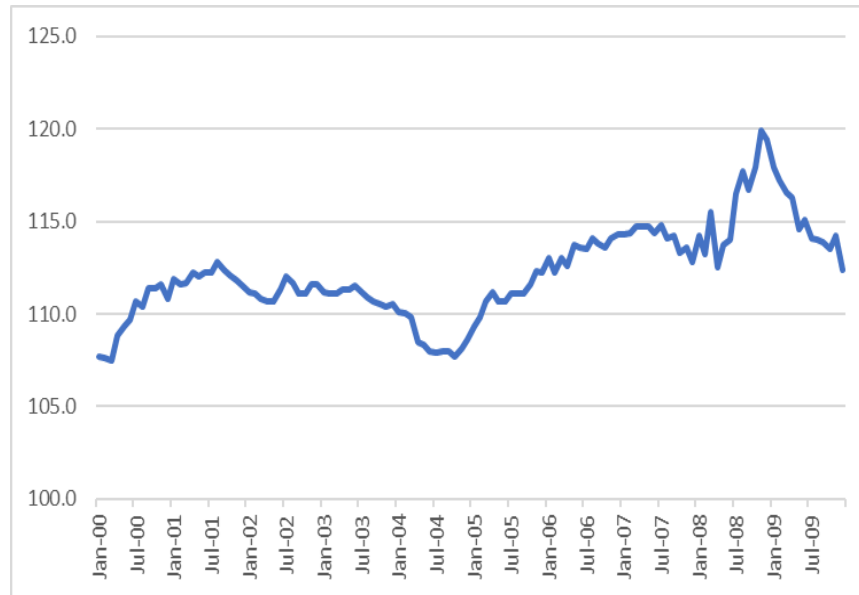


Fig. 26. U.S. Bureau of Labor Statistics, Producer Price Index by Commodity for Non-Metallic Mineral Products: Flat Glass [WPU1311], retrieved from FRED, Federal Reserve Bank of St. Louis;
<https://fred.stlouisfed.org/series/WPS0543>

Still, it is reassuring that flat glass prices show a pattern of substantially lagging the launching of the cluster of non-residential construction projects. However, the scope of this work precludes us from considering the flat glass market in detail. Instead, the following section will be devoted to the analysis of the pre-Great Recession developments concerning an input into non-residential construction that underwent a much more rapid price appreciation, namely, steel construction components.

5.5.2 Steel Construction Components as A Candidate Contested Good

Steel products, especially those forming the superstructure of buildings, are perhaps the most important and costly single component of non-residential construction costs. According to Buildingsguide, steel components may account for almost half of the cost of construction per square meter, although, by their own admission, actual cost breakdowns may vary significantly depending on the type of building and the relevant regulatory requirements.

Another way to assess the importance of steel costs for non-residential construction costs is to compare the evolution of the construction steel PPI to the overall PPI for materials and components for construction on a graph (see Fig. 27 below). Also included in the graph is the PPI for all commodities.

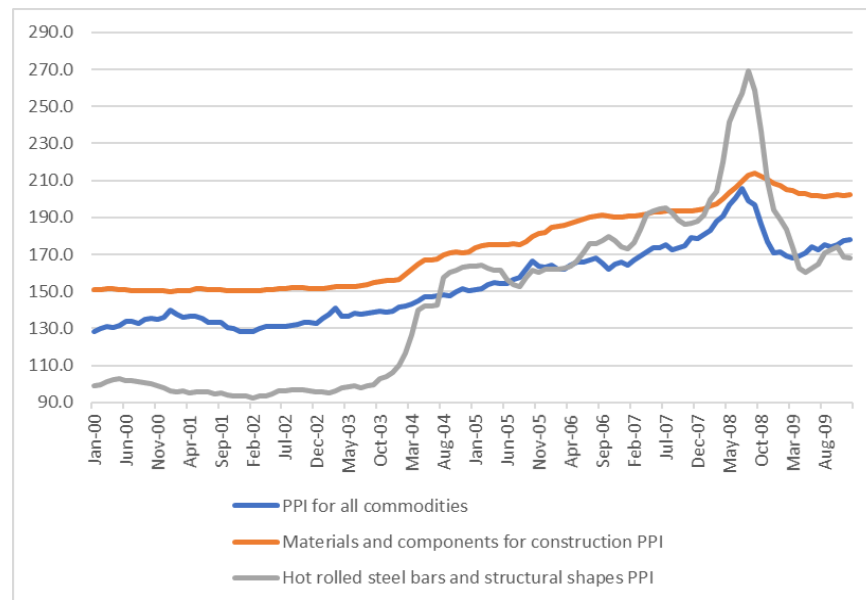


Fig. 27. Steel construction components PPI vs. the PPIs for other commodities, data series PPIACO, WPSID612, WPU101704

The PPI for hot rolled steel bars and structural shapes was chosen to represent steel components for non-residential construction. In practice, the choice does not make much of a difference because cold rolled components that may also have been used in the construction projects in question are essentially products that first underwent hot rolling and then some additional millwork.

With regard to the PPI graph, the first thing it makes clear is that although commodities have on average experienced a sharply upward trajectory over the period, steel components have far outperformed them in this respect. Steel components have also appreciated far more than the materials and components for construction. As we mentioned in the preceding section, the comparative dynamics of construction materials and components versus all commodities suggest that there was a general boom in construction that started substantially earlier than the most intense phase of the commodity boom, especially driven the price of oil. The dynamics of the steel construction components mirror those of construction components and materials, thus probably

excluding the objection that the dramatic increase in steel prices was merely part of a more general phenomenon related to the global economic growth in the period. The issue of the relation of steel component prices to the global economy, and especially the factor of the ascending China, will be discussed in more detail below.

The second issue that needs to be addressed in this section is the relation of steel construction components PPI to the PPI for construction components and materials and its apparent implications. It has to be noted in this regard that, as we mentioned above, the boom in housing construction, while partly overlapping with the one in non-residential construction, preceded it and ended earlier (in early 2006). The fact that the PPI for all construction components rose by almost 10%, while housing construction was falling but steel component prices were rising rapidly, bolsters the case for a high significance of steel costs in non-residential construction projects.

This seems to give substantial support to the idea that steel construction components were a contested good during the run-up to the Great Recession because they underwent a rapid appreciation with a roughly two-year lag with regard to the time spending on private non-residential construction started to grow. We may also remind ourselves that the major CityCenter project described in the Preamble was started in 2005. In addition, there is a ready explanation why the potential cluster of excessively long non-residential construction projects started exerting especially strong pressure on steel component prices when it did in late 2007. First, the decline in housing construction started in early 2006 and continued unabated, thus counteracting whatever pressure may have initially come from non-residential construction. However, if one considers at which stage of non-residential construction steel components are used the most, it becomes clear that that is not the initial stage where the foundation is laid but rather when the building's superstructure starts to be erected. If we use CityCenter as a guiding example again, its construction was actually launched in 2006. If other projects within the cluster resembled City Center, then it is not surprising that they started using significantly more steel in the second half of 2007. Even more impressively, if we recall the evolution of delinquency under the ADC loans that was discussed above, they started facing serious repayment difficulties essentially at the same time as steel prices skyrocketed, which, as was mentioned in the preceding chapter, is a strong sign of steel components being a contested good.

However, before we can conclude that steel components were a plausible candidate for the contested good during the 2000s nonresidential construction boom, two important complicating issues need to be addressed. To start with, as Fig. 27 above makes clear, steel component prices had already undergone a dramatic appreciation in late 2003 – 2004, presumably because of the U.S. economic recovery, the beginning housing boom and the global economic growth. Given this, it may reasonably be asked why the originators of the potential excessively long projects did not take the possibility of another such price soaring into account in their project calculations. There may be several not necessarily mutually exclusive potential responses to this challenge. First, the originators in question may have only looked at the steel component prices at their level in late 2004 when they temporarily stabilized. Secondly, they may have considered the appreciation a one-off event during the economic recovery. Finally, they may not have separated the construction cost appreciation that was taking place in 2004 into components, and thus may not have paid sufficient attention to the developments concerning steel. If the Turner index discussed above is a good approximation of non-residential construction costs, it shows that non-residential construction costs rose much slower than they did in the subsequent years. However, the question how project originators form their cost expectations and at what detail and how far into the past they look at the prices of particular components is an important question that merits attention in further research.

Another potential challenging fact is that steel component prices started declining quickly in October 2008 and by the end of January 2009, they had lost 27%, whereas nonresidential construction spending fell slowly over the same period. This is puzzling because one would expect that if the soaring steel prices contributed to the troubled state of many non-residential construction projects, their quick decline should have provided the latter with some respite.

A potential response is that despite the fact that the non-residential construction projects were clustered they did not have to be completely synchronous. Those projects that faced particular difficulties may have been those projects which started using steel components heavily a bit later than the others, thus soaring steel prices may have caused them more trouble, and they may have reduced spending on steel, just as their more advanced (in terms of completion) counterparts may have already switched from using steel components heavily to using other inputs. If those inputs were at that moment more expensive than the steel components those projects had used

beforehand, this may well have maintained nonresidential construction spending for some time. Then, when the more advanced projects reached closer to completion and decreased spending, and the less advanced ones stopped at the steel superstructure stage, the total spending collapsed, too. In addition to this, as was mentioned above, the originators of some excessively long projects may respond to a sudden increase in costs by reducing spending on other activities.

The final potential difficulty stems from the globalized nature of the modern economy meaning that prices for resources aren't just or necessarily determined within the national borders. During the same period as the major expansion in non-residential construction was taking place in the U.S., a major expansion was still ongoing in many countries, especially in China. It is quite plausible that what looks like an appreciation in steel component prices caused by the non-residential construction boom was actually merely a local U.S. consequence of the global resource boom. While in-depth research which is beyond the scope of this work is needed to do justice to this issue, an attempt is made in the following section to give a *prima facie* response to it.

Was the 2008 U.S. steel price spike primarily caused by the internal factors?

The first glance at the evolution of the global, China's and U.S. annual steel production in the pre-Great Recession period (Fig. 28) may suggest that China's impact on the global steel market must have dwarfed any other factors, given the increasingly large share of the global production that China accounted for. However, more detailed analysis of both the situation in China and the U.S. suggests that this initial impression is questionable and that internal U.S. factors may well have been more impactful than the external ones.

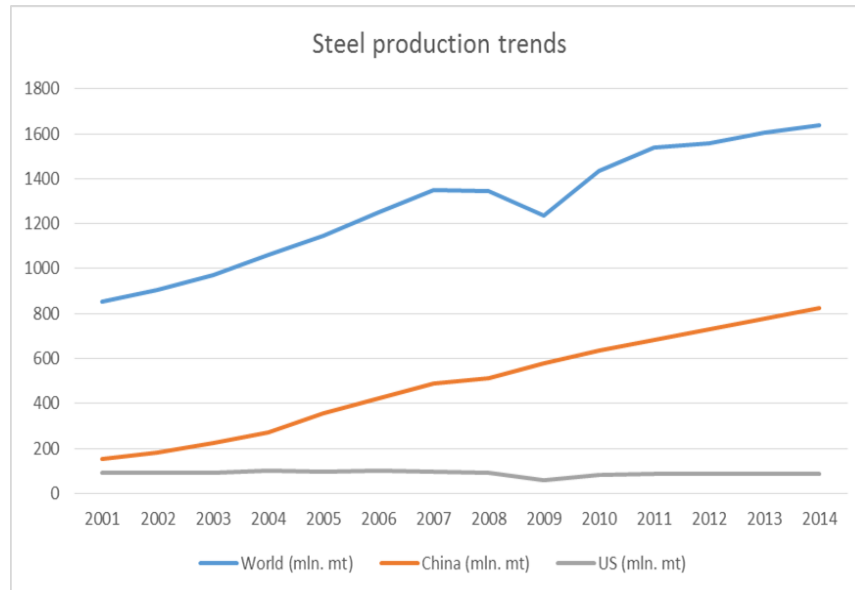


Fig. 28. Steel production in the world, China and the U. S. (million metric tons). Source: World Steel Association

First of all, one has to note that the Chinese annual steel production in 2008 stayed almost flat compared to 2007, although, like in the U.S. steel production in China may have exhibited more complicated dynamics throughout the year. However, the data from Trading Economics (China Steel Production) on monthly steel production suggest that there was no massive expansion.

In addition to this, according to the data (Fig. 29) presented in the report on the Chinese steel industry for the Congressional Research Service by Tang,⁹⁸ until well into 2008, apparent crude steel consumption in China actually lagged behind its production, which, according to Tang, was evidence of deliberate creation of overcapacity and insufficient export orientation of the Chinese steel producers at the time. The monthly production increase in 2008 which at its peak was around 7 million tons was in annualized terms roughly within the bounds of the annual production-consumption gap according to Tang. This suggests that there was *prima facie* not sufficient pressure from the Chinese demand to have a major direct impact on the U.S. steel prices.

⁹⁸ Tang 2010, p. 6.

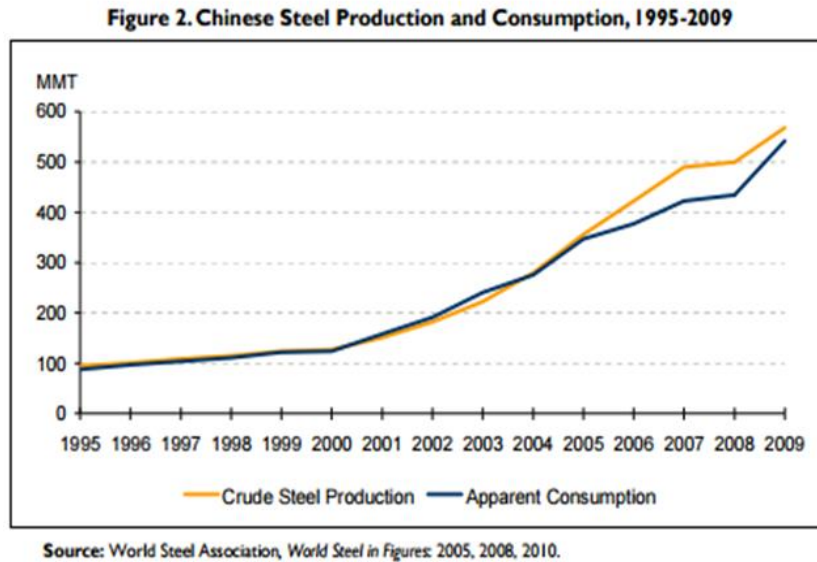


Fig. 29. Chinese steel production and consumption (million metric tons).⁹⁹

Moreover, if we consider the proxies for the actual monthly steel product prices in the U.S. and China during the period (Fig. 30), we will discover that, while there was a substantial price increase in China in 2008 (from around \$500 to around \$700), the benchmark steel product price in the U.S. doubled. The apparently very close correlation between the U.S. price and the Western European and world export prices are a matter of concern but one has to note that the prices in question are mostly export prices and, in addition to the non-residential construction boom in the U.S., construction also boomed elsewhere (e.g. in Spain and Ireland), which implies that internal factors in many economies were driving steel export prices up.

⁹⁹ Tang 2010, p. 6.

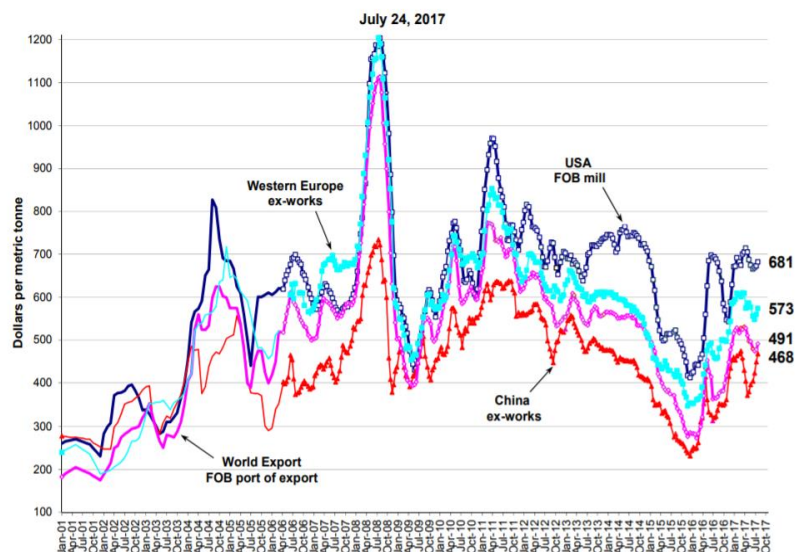


Fig. 30. Hot-rolled band export price¹⁰⁰

At the same time, a substantial body of evidence suggesting that steel production in 2008 temporarily exceeded in annual terms the levels of 2007 and the increase was driven by non-residential construction can be derived from the annual reports of two major US steel producers, US Steel and Nucor.

According to the U.S. Steel's 2008 annual report,¹⁰¹ even despite the fact that economic crisis hit at full force in the fourth quarter of 2008, annual steel production in its biggest segment (flat-rolled products) rose by 14%. Total steel shipments increased by 10.6%.¹⁰² The report noted¹⁰³ that the biggest drivers of demand in its biggest segment (more than 50% of sales) were the automotive and construction markets. However, the share of these markets in its market breakdown¹⁰⁴ is notably lower, which suggests that other market categories (like steel service centers and trade customers) also demanded steel products ultimately used in construction. This, in addition to the similar discrepancy in the USGS data noted above calls for more detailed estimation of the share of the construction industry in the U.S. demand for steel in further research.

¹⁰⁰ SteelBenchmarker, p. 3.

¹⁰¹ United States Steel Corporation 2009, p. 7.

¹⁰² United States Steel Corporation 2009, p. 10.

¹⁰³ United States Steel Corporation 2009, p. 14.

¹⁰⁴ United States Steel Corporation 2009, s. F-65.

U.S. Steel's production in the narrow category of construction and construction products increased by 27.6% in 2008.

Nucor's 2008 annual report noted¹⁰⁵ that much of the demand for the company's steel products was driven by the non-residential construction sector. According to the report, annual steel production (measured in tons) fell by 7% compared to 2007. Nucor's steel production in the fourth quarter of 2008 fell by 44% compared to the third quarter of the same year. The physical capacity utilization rate fell from 91% in the first three quarters to 48%.¹⁰⁶ Taken together, these statements strongly suggest that steel production by Nucor in the first three quarters of 2008 was substantially higher than in the same period of 2007 and that the increased demand from the nonresidential construction sector was an important driver of the process. Importantly, according to the same report,¹⁰⁷ energy costs for steel production in 2008 increased only by 16% per ton, which means that the global fuel price boom was not a decisive factor in the soaring steel price.

Finally, an important thing to note is that steel component prices (Fig. 27) started falling rapidly in October 2008, relatively simultaneously with the spending on nonresidential construction projects, which further indicates the connection between the two. It may be objected here that the steel component prices fell much faster relative to the spending on non-residential construction (Fig. 14) that after the initial decline by 22% by January 2009, even rebounded a bit until June of the same year when it collapsed again. During this whole period, steel component prices kept falling. Hence, the alternative explanation is that steel component prices fell as a result of the financial crisis that hit the U.S. economy in October 2008.

However, what this may indicate, instead, is that a large part of the potentially excessively long non-residential construction projects may have pulled through the stage where they required extensive use of steel components, with the help of their originator businesses slashing spending on other lines of activity. But the part of the projects that potentially have not been able to achieve this feat may have driven the steel component prices down. This is not to deny, of course, that the collapse of steel component prices may have also been partially driven by other crisis developments not directly related to the potential excessively long projects.

¹⁰⁵ Nucor Corporation 2009, p. 2.

¹⁰⁶ Nucor Corporation 2009, p. 10.

¹⁰⁷ Nucor Corporation 2009, p. 10.

5.6 The Closer-to-consumption Projects and the nature of the contested good market dynamics

As discussed in the preceding section, in order to establish the candidate contested goods it is not sufficient to merely demonstrate that they were utilized by the potential excessively long projects. Rather, it needs to be shown that the projects in question at some point started manifestly competing for the candidate contested goods with the candidate closer-to-consumption projects.

There are at least two potential ways in which the competition for the contested goods that presents financial difficulties for excessively long projects viable may unfold. In one scenario, excessively long projects may temporarily divert the contested goods away from the closer-to-consumption projects, only for consumers to boost the prices of the consumer goods whose production the closer-to-consumption projects facilitate at some later point. In this case, the closer-to-consumption projects should exhibit reductions in activity.

The other scenario in which establishing the closer-to-consumption projects may be much more difficult takes into account the feature of many modern production processes according to which their physical capacity is usually not completely utilized. This means that it is possible for the contested good producers to increase production to meet the added demand up to a point without reducing production for other customers if all the customers are prepared to cover the cost of the production increase. This may be the case if the originators of the excessively long projects stick to them despite the contested good price increases that overwhelm their margins of error stick to them through reducing spending on other activities or temporarily continue implementing them in the hope of securing additional financing from banks or other sources.

Given the scope of this work and the complexity of determining the closer-to-consumption projects, here, only two potential categories of closer-to-consumption projects are considered, which, however, appear to be rather significant. As the graph in Fig. 31 suggests, the two major categories of investment according to the Bureau of Economic Analysis' classification exhibited quite different evolution over the 2000s business cycle episode. Investment in equipment started rising in early 2004, then reached a relative plateau by early 2006. In first three quarters of 2008, it underwent a contraction and then declined significantly but it started to rebound in early 2010.

At the same time, investment into structures started rising substantially only in the second half of 2005 (which more or less corresponds to the pattern in nonresidential construction spending that we discussed above) and continued growing until the acceleration of the economic-wide downturn in October 2008. The crisis led to this type of investment collapsing and stagnating until the early 2011.

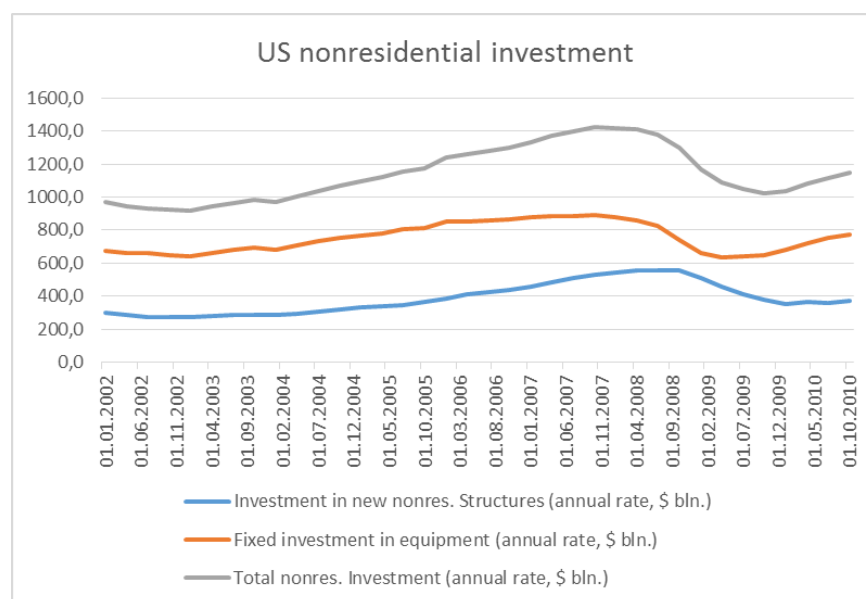


Fig. 31. U.S. nonresidential investment (US\$ billion). Source: Bureau of Economic Analysis Investment Accounts

It is especially interesting what happened to these two types of investment when the growth of nonresidential construction spending reached its peak acceleration. From the first quarter of 2007 to the third quarter of 2008, investment into structures grew from \$456,7 bln in annual terms to \$558,6 bln. Meanwhile, investment in equipment was relatively stagnant until the first quarter of 2008 and then fell from \$890,4 bln to \$822 bln in the third quarter of 2008. Even more importantly, most of the decline in investment in equipment was concentrated in investment in transportation equipment which in the first three quarters of 2008 fell in annual terms by \$46,6 bln. (which represents 68,5% of the decline in investment in equipment in the first three quarters of 2008). Given that steel is an essential input into the production of all kinds of transportation equipment, the aforementioned decline in transportation equipment investment makes the hypothesis that projects involving investment in equipment were the closer-to-consumption projects that we are interested in.

This pattern seems to suggest that the contested good market dynamics scenarios were both present in succession with regard to the investment in transportation equipment. First, both the projects involving investment in transportation equipment and the non-residential construction projects appear to have been able to pay the higher prices for steel components. Then, the latter projects may have started bidding steel components away from the former.

Another potential type of closer-to-consumption projects in the period under study is automobile production, given how much steel a typical automobile requires. According to the estimates as of 2015 (Kallstrom 2015), steel costs contributed 22% of the cost of an automobile. Given how much steel prices soared in 2008, this figure was probably higher for an average automobile back then. In the case of automobiles (Fig. 32), the first of the aforementioned contested good market scenarios may have applied.

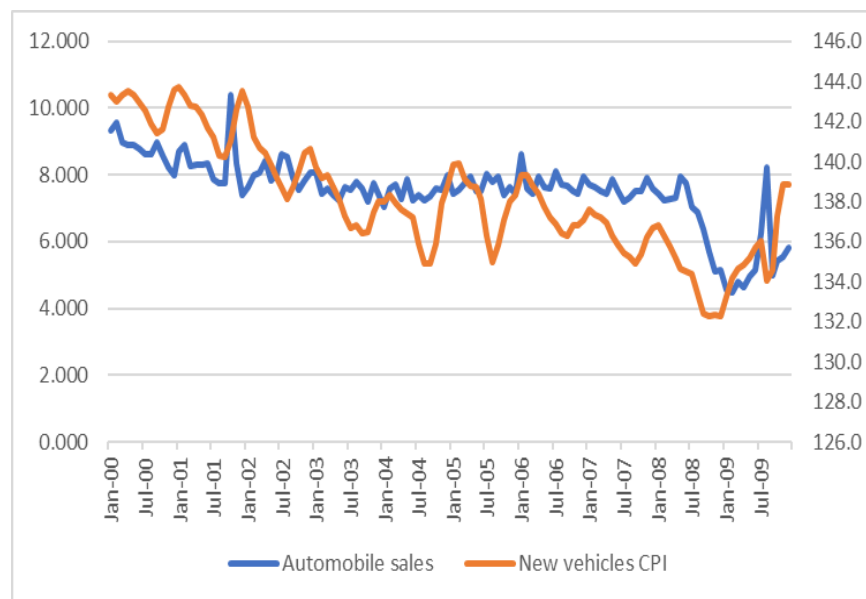


Fig. 32. Bureau of Economic Analysis. Automobile unit retail sales (US\$ million, annual rate, seasonally adjusted), retrieved from https://www.bea.gov/national/xls/gap_hist.xlsx on August 23, 2017; U.S. Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers: New vehicles [CUUR0000SETA01], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/CUUR0000SETA01>, August 23, 2017

It has to be noted here that the pattern of automobile sales in 2008 was probably affected not just by the competition for steel with nonresidential construction but also by the deteriorating conditions in the US economy in general. However, the case for ABCT providing part of the explanation for the automobile sales decline is based on the fact that the automobile manufacturers

were apparently unable to substantially reduce prices even in the face of a rapidly declining demand, as evidenced by the new vehicles CPI data also plotted in Fig. 32.

It is also worth mentioning here that what we are observing here with regard to the auto industry is another example of a negative interaction between the potential ABCT-described boom and the subsidy-driven boom. It is quite probable that auto sales fell so rapidly in the second half of 2008 both because some consumers needed to pay more to service their deteriorated mortgage debts, and because auto producers were unable to reduce automobile prices sufficiently. This probably contributed to the deteriorating recession.

The above discussion of the candidate closer-to-consumption projects raises the question, however, whether the whole extent of the financial difficulty the candidate excessively long projects faced was caused by their competition for with the identified candidate closer-to-consumption projects and, more generally, what the response of the originators of the excessively long projects was to the financial difficulty.

It should first be noted that if the candidate excessively long projects have faced the difficulty caused by the higher contested good prices, their originators mostly appear to have adjusted to the latter by reducing spending on other activities rather than slamming the breaks on the excessively long projects, just as MGM did with respect to the CityCenter, or at least by reducing the utilization of inputs other than the candidate contested goods. The key reason for this conclusion is that the candidate closer-to-consumption projects do not appear to have acted to reverse the diversion of the steel components to the candidate excessively long projects. However, the verification of the validity of this conclusion as well as the identification of the kinds of activities on which the candidate excessively long projects reduced spending to compensate for the rise in the contested good prices are beyond the scope of this work and should be subject of the future research.

Adding to this, in line with what was suggested in chapter 2, the increase in the prices of the contested goods may have partly been caused by many candidate excessively long projects converging on more intensive usage of the candidate contested goods at roughly the same time. The particular manifestation of this theorized phenomenon may have taken the form of many non-residential construction projects entering the stage of the creation of the building superstructure

that requires a particularly high usage of steel components. However, as with the kinds of reduced spending discussed in the preceding paragraph, the assessment of this hypothesis has to be left to the future research.

5.7 The Potential Collateral Objection

The most serious potential objection to the idea that the evidence that I presented suggests that long-term construction projects contributed substantially to the Great Recession in the US and that their problems are explicable by ABCT is that many of those projects could also have been put into difficulty by collateral problems. It is a common lending practice to include terms into construction loan agreements that worsen the position of the borrower in the case of collateral deterioration.

To clarify this point, first, some loans to long-term construction projects are made in the form of credit lines with certain conditions for advancing each new portion of the loan, as the project is undertaken. One of the most important conditions in such loans is collateral, namely, the construction site and the object under construction normally become the basis for securing the project loan.

It is not difficult to see that in case the object of the collateral loses a significant part of its market value, this may result in the lender's refusal to advance the remaining portions of credit financing in accordance with the credit line conditions. Secondly, even if the loan is made in a single disbursement, the lender may demand a higher interest rate on the remaining principal to be repaid, which the originator of the project may be unable to shoulder. This may obviously lead to the failure or freezing of the relevant construction project in a way which is different from the one described by ABCT.

Indeed, this mechanism probably played a role in some of the troubles faced by long-term construction projects in the US during the Great Recession as evidenced by the financial regulators policy statement (2009). However, the most important question is to what extent the declines in the market value of the collateral may explain those troubles. Although it is impossible at this stage

to give a relatively straightforward answer, there are serious reasons to believe that this factor may not explain much.

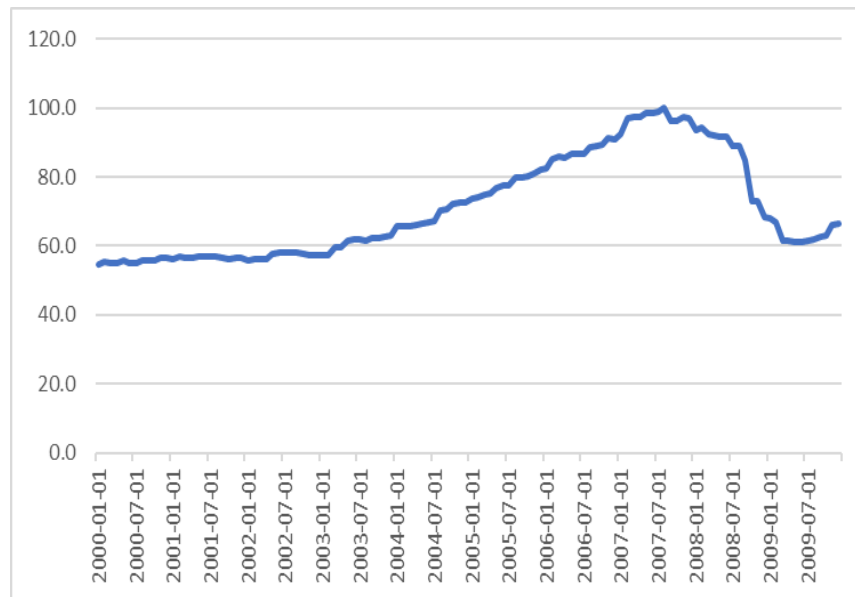


Fig. 33. Green Street Advisors U.S. Commercial Property Price Index, retrieved from <https://www.greenstreetadvisors.com/insights/CPPI> on August 25, 2017.

First, if we consider the dynamics of commercial property prices in the U.S. in the 2000s (Fig. 33), although they started declining in September 2007, this decline was initially slow, and only accelerated a year later, in September 2008. As we have seen in the section devoted to ADC lending, by the latter moment a substantial share of underlying non-residential construction project had already been facing repayment difficulties. It is unlikely, however, that those difficulties were caused by a slow 10% decline in the average collateral prices, although it may have been in some cases where prices could have declined substantially below average, because banks are usually reluctant to force borrowers into defaults and taking over the collateral, unless the soundness of the underlying project is clearly questionable.

Secondly, the collateral deterioration vector and the ABCT-described mechanism do not have to be mutually exclusive factors. In many cases, collateral deterioration may have been caused by the general economic crisis dynamics. For instance, the demand for hotels and casinos' services falls during crises, which temporarily reduces their expected profitability and thus the prices of the relevant real estate. However, when this is accompanied by the presence of an excess credit-driven

cluster of projects involving the construction of a significant stock of such buildings, this creates a negative synergy.

5.8 The types of construction disproportionately involved the boom and the final boom size estimate

The preceding sections of this chapter dealt with the evidence in favor of nonresidential construction undergoing an ABCT-described malinvestment boom from 2005 to 2008. However, a major question that remains unanswered is what part of the increase in the private non-residential construction spending during that period constituted a potential cluster of malinvestments. The main reason this question needs to be at least roughly answered is that it is important for establishing the magnitude of the potential negative impact of the nonresidential construction boom and bust on the wider economy, and hence, its relative role in the U.S. Great Recession.

To this end, it may be helpful to determine the industries which were at the heart of the non-residential construction boom if it was not uniformly distributed. This may also be helpful for the future research, especially for the potential surveying of the management of the candidate excessively long projects in order to clarify the reasons for project failure and underestimating the projects' costs. U.S. Bureau of the Census annual data on the value of private nonresidential construction put in place are broken down into a detailed list of the industry building types.

If we consider the structure types that accounted for the biggest shares of the overall private nonresidential construction spending increase, the structure types that totaled more than 5% were electric power (19%), lodging (14%), general office (13%), shopping centers (8%), multi-retail (8%), communication (8%), petroleum/coal (8%) and hospitals (6%). Taken together, these structure types account for 84% of the change.

Industry structure type	Share of the spending increase in the in the total increase in spending on private nonresidential construction in 2008 over 2004	Percent increase over the 2004 Level
Electric power	19%	152%
Lodging ¹⁰⁸	14%	195%
General office	13%	75%
Shopping center	8%	146%
Multi-retail	8%	70%
Communication	8%	70%
Petroleum/coal	8%	1170%
Hospitals	6%	58%
Total private nonresidential Construction		72%

Table 1. Breakdown of private nonresidential construction spending based on the data by the U.S. Census Bureau. Data retrieved from https://www.census.gov/construction/c30/historical_data.html on September 11, 2017.

If we also check the magnitude of construction spending increases for the relevant industries (Table 1), we may notice that all of them, except for spending on hospital construction rose at the average rate for private nonresidential construction or more. However, at least as a preliminary step, we will need to exclude electric power structures and petroleum/coal structures from consideration because those were probably significantly affected by the boom in energy prices if not fueled entirely by it. Further evidence against including electric power structures is provided by the fact that the magnitude of construction spending on them increased only slightly in 2011 compared to the 2008 peak. If we also exclude hospitals the spending on which grew below average, the overall excess spending over the 2005-08 period compared to 2004 is \$218.8 bln.

¹⁰⁸ Interestingly, nonresidential construction spending on lodging structures underwent the second largest percentage increase, which dovetails nicely with the example of the CityCenter project discussed in the Preamble.

If we consider the evolution of the separate components included into this estimate (Fig. 34), we may see that all of them fall within the 2005-2008 boom pattern, even if it is not identical for all the spending categories, and somewhat less pronounced for multi-retail structure construction.

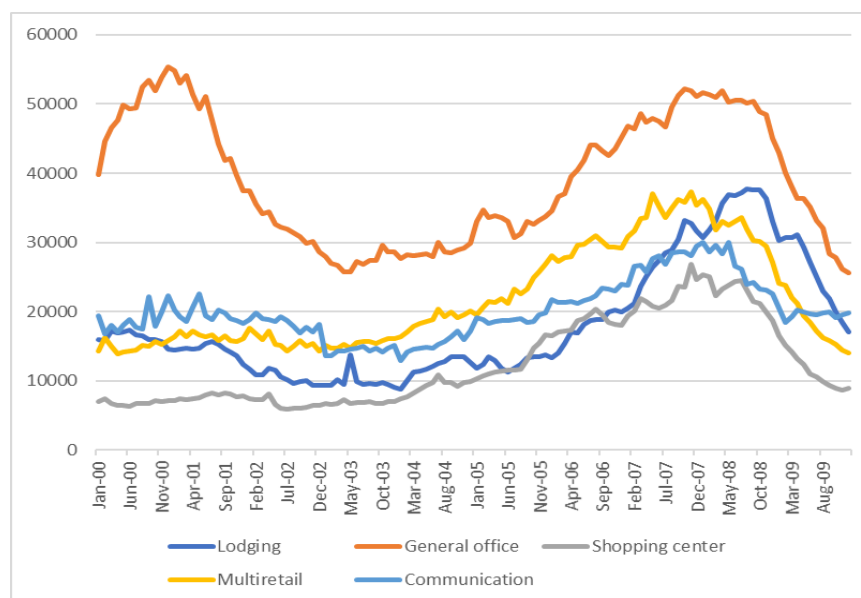


Fig. 34. Private nonresidential construction spending categories included in the cluster size estimate (US\$ million).

Source:

U.S. Census Bureau.

There still remains the question whether construction spending on multifamily buildings should be included since even though it does not qualify as nonresidential construction spending, it is largely similar to it in its effects. As it was already mentioned above, its scale was not significant compared to the overall construction spending. In addition, its dynamics in the period (Fig. 35) under analysis suggest that it the boom in it largely happened roughly simultaneously with the 1-4-family housing counterpart, although it has to be noted that private multifamily building construction spending did not decline as fast as 1-4-unit construction spending, which may imply that some of it came into being as part of the potential cluster of excessively long projects. However, determining whether this was indeed the case is beyond the scope of this work, hence this construction spending category will not be included in the cluster size estimate.

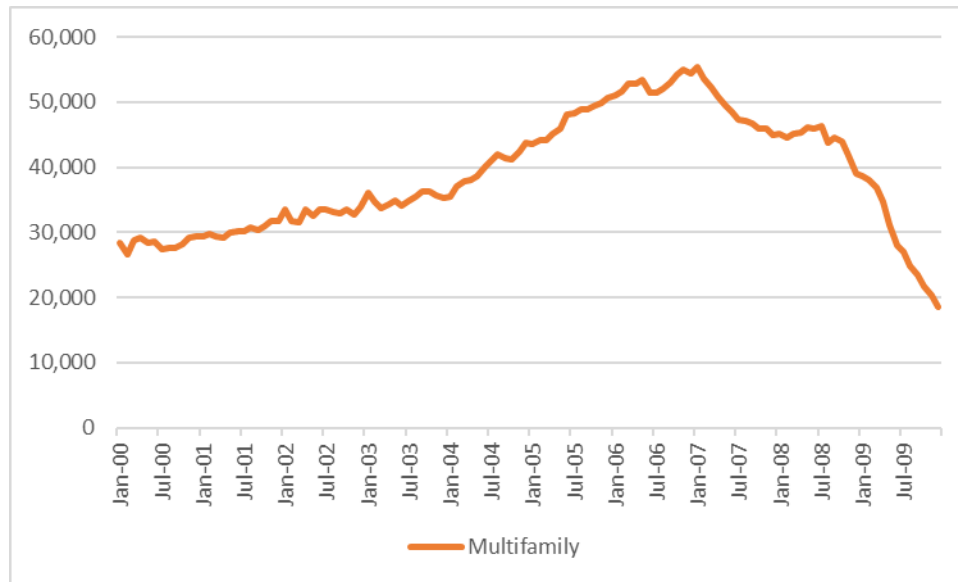


Fig. 35. Private multi-family building construction spending (US\$ million). Source: U.S. Census Bureau

To come back to the malinvestment cluster size estimate, even with the somewhat arbitrary cut-off share of 5% of the overall nonresidential construction spending increase, this figure is most probably an overestimate of the size of the potential excessively long project cluster since some of the investment into relevant structures may well have been driven by the genuine economic recovery and growth that took place in the pre-Great Recession period. This aspect is particularly evident in the U-shape pattern exhibited by general office construction spending in Fig. 34. At the same time, the estimate derived from the ADC loans data is \$73.6 bln. Given that there seemed to be more reasons to consider that estimate to be understating the extent of the bubble, it looks reasonable to use an average between that estimate and the industry-breakdown-based estimate to arrive at the final preliminary estimate, which is around \$146.2 bln.

5.9 Estimating the size of the potential nonresidential construction boom and its impact on the economy as a whole

The key conclusion that can be made from the analysis in this chapter is that the evidence from the early 2000s considered above is sufficient to *prima facie* establish a candidate cluster of excessively long projects in the form of non-residential construction projects and the equivalent

residential ones after the U.S. Federal Reserve loosened monetary policy to boost the recovery from the ‘dot-com recession’. This cluster was largely financed via a highly pronounced cluster of ADC loans whose volume started growing rapidly in the late 2004 – early 2005. Those loans later faced disproportional repayment issues and declined more even in absolute terms relative to other types of loans in the U.S., even the mortgage loans for 1-4 family housing. Analysis of the BEA data on non-residential structure investment by industry allows establishing the industries where such spending constituted a significant part of their costs, which makes those industries prime candidates for the locus of the ABCT-described boom.

In the preceding section, we used the industry structure type breakdown of private nonresidential construction spending in conjunction with the ADC loan – based one to arrive at the final estimate of \$146.2 bln. In itself, this whole cluster of spending spread over 4 years (even if skewed towards 2007 and 2008) constituted around 1% of the annualized U.S. nominal GDP in the third quarter of 2008, and thus, it has to be concluded that the candidate cluster of excessively long projects in itself was not sufficient to be a significant cause of the U.S. Great Recession.

However, the results of the research conducted herein remain useful for two main reasons. First, as was indicated at several points above, there are several potential channels of interaction between the cluster of excessively long projects and the associated ADC loans and the wider economy – from the bolstering of the credit crunch to the failure of automobile prices to fall because of the high steel costs probably driven by the booming nonresidential construction.

Secondly, and most crucially, one needs to bear in mind that the increase in ADC lending constituted only a fraction of the total lending increase over the run-up to the Great Recession. Hence, if substantially more excess credit had been allocated to longer-term investment projects, the size of the ABCT-described boom and its economic impact may well have been much greater. Thus, the latest U.S. boom and bust episode provides potential lessons for monetary policy-makers in the future.

5.10 The potential excessively long projects abandoned at the preliminary stage

Finally, as was stated in chapter 2, credit expansion may potentially not just result the actual undertaking of a cluster of excessively long projects but can also prompt R&D and other preliminary activities that mostly do not result in the use of physical inputs on a large scale. These activities, however, may have other ramifications for the economy.

In particular, the planning, regulatory compliance efforts and research that go into those activities could well have been allocated to preparing the launch of other investment projects that could be realizable. This effect is especially important if the abandonment of the prepared but not launched projects coincides with the bust phase for the excessively long projects and other possible economic decline phenomena like the decline in the housing construction in the U.S. following the subprime bubble. If realizable projects had been launched, they could be there to fill at least part of the spending gap created by the discontinued activities and mitigated the severity of the downturn.

In this regard, there is some evidence for the 2000s suggesting that there was a cluster of projects of coal-fired power plants construction that were proposed between 2000 and 2006 and abandoned in 2007 and 2008. In particular, according to Sourcewatch, in May 2007, the report by the National Energy Technology Laboratory¹⁰⁹ listed 151 coal-fired power plants that were proposed to be constructed in the U.S. According to Sourcewatch, as of September 2017, 110 of those projects had been canceled, abandoned or put on hold. Given that projects involving the construction of coal-fired power plants tend to be substantial not just in terms of input uses but also the aforementioned non-physical-input-intensive activities, the fact that so many coal-fired power plant construction projects were abandoned after May 2007 warrants considering at least some of them as potential excessively long projects abandoned at the preliminary stage.

It needs to be noted, however, that the evidence that is available at the moment is of a relatively speculative nature,¹¹⁰ given that it is not possible to use it to estimate the potential total investment spending of the abandoned projects and, more importantly, that it is not wholly clear

¹⁰⁹ This author did not manage to retrieve the text of that particular report.

¹¹⁰ The source for the evidence about the coal-fired power plants - the Coalswarm project¹¹⁰ of SourceWatch – is admittedly not a highly reputable one. However, while it was not possible to locate the text of the May 2007 NETL report, some reports on new coal-fired power plants published by it are publicly available.

how many of them were mostly abandoned primarily or to a large degree because of the rapidly rising construction costs.

Another important caveat is that, according to the NTEL 2009 report,¹¹¹ already by the end of 2007, instead of the 36,000 MW of new coal-fired power plant electricity generation capacity that was envisaged in the 2002 report to be have been installed by 2007, only 4,500 MW were actually installed. Given that, as discussed above, the bulk of the potentially ABCT-described increase in the price of steel construction components that could have been used in the construction of new coal-fired power plants happened in early 2008, this suggests that the abandonment of the coal-fired power plant projects after May 2007 may have been largely unrelated to the mechanism proposed by ABCT. It still appears, however, that this issue warrants a more detailed analysis in the future research.

¹¹¹ Schuster 2009, p. 5.

Thesis Conclusions, Caveats and the Avenues for Further Research

The big-picture takeaways

In this work, a new approach to ABCT was developed in which the theory was formulated without reference to the APS construct or equilibrium constructs and with an explicit focus on the actual investment projects that are envisaged by the theory to be erroneously undertaken as a result of central-bank-induced credit expansion. The theory was then illustrated by means of an agent-based computer model and applied to the latest boom-and-bust episode in the U.S. economy, the (initial stages of the) Great Recession and the run-up to it in 2003-2008.

Before discussing the potential qualifying points and the avenues for further research, let us ponder the place of this work in the general body of the modern economic research. It was already mentioned previously that this work is methodologically quite distinct from the predominant approach to formulating economic theories as well as to comparing them to the realities that they are supposed to illuminate. Here, a few more words need to be said in this regard.

The potential major contribution of this account of ABCT, even if it is not in the future found to be logically incoherent or in some way inapplicable to the modern economic phenomena, is that it resurrects the qualitative (rather than quantitative) approach to economic theorizing and empirical investigation.

The theory formulated here is fundamentally qualitative in that no attempt is made to explicitly or implicitly formalize it using mathematical modeling. Its empirical approach is qualitative in the sense that it does not rely on econometric methods to claim the probable causal role of the U.S. Federal Reserve's credit expansion in the early 2000s and the subsequent cluster of erroneous non-residential construction projects that is proposed to have been present.

Of course, the methodological stance taken here is not chosen for the sake of contrarianism or the desire to stick to the perceived commitments of the tradition of the Austrian School of Economics to which this author must admit to belonging. Rather, it is rooted in the conviction it is

this approach that is more likely to bring to fruition the basic intuitions underlying ABCT, especially the idea that the troubled investment projects whose undertaking the theory strives to explain involve genuine errors rather than some sort of an optimal response to incentives that the environment creates.

The general spirit of the approach developed here may probably be used in other areas of economic inquiry, in particular, those dealing with other consequential clusters of errors created by external distortions of the price mechanism. One important example of such clusters is the chain of errors that can be created by government subsidies to the production of certain goods and services.

The housing and related subprime loan and mortgage-backed security bubbles in the U.S. in the 2000s are an important historical episode. The key potential types of errors involved there were those committed by some of the borrowers who thought that the housing prices would continue to rise, the errors committed by banks that concentrated too much of their activities in mortgage lending, those of the developer and construction companies that expanded their business too much in anticipation of the continued boom, those of the investment banks and other financial institutions that purchased excessive numbers of mortgage-backed securities of various degrees of proximity to the underlying collateral, and potentially, even the decisions of some of the members of the labor force who chose to be construction workers because of the seemingly favorable outlook for the construction industry.

It is also warranted to consider here to what extent the empirical application of the theory developed in this work can be judged a success, and what this implies for the theory as a whole. Of course, the particular historical episode studied in this volume was primarily chosen because of the high quality of data available for it and not because there were preexisting reasons to believe that it is particularly likely to contain the ABCT-envisaged pattern.

In this regard, it is somewhat optimism-inspiring that substantial *prima facie* evidence for just such a pattern was discovered perhaps the most impressive of which is the cluster of ADC loans. It is *ex ante* rather unlikely to find such evidence in an episode selected in such a way. It also bodes well for the theory that it was possible to discover the evidence in a relatively clear-cut way, despite the enormous complexity of the modern economy.

Caveats

The relative disregard of labor

One of the most obvious weaknesses of the research described in this volume is that it almost completely disregards labor both as a potential contested good and in other potential respects.

Nothing prevents labor from being a contested good in principle but it is a question for the future research whether it has important specificities in this regard that need to be fleshed out and taken into account in the empirical application of ABCT. One of such potential special features may have to do with the fact that it may not be possible to trap labor in the excessively long projects in the way certain capital goods can be trapped (for instance, if certain equipment is tailored to the needs of a specific project to the point that it is uneconomical to repurpose it).

An important manner in which labor needs to figure in the future, more extensive versions of ABCT is through the consideration of the effects of the changes brought about by the changing pattern of income because of reallocating employees to the excessively long projects. The most important issue that this raises is whether such changes are affecting the invariance of consumption preferences.

Caveats related to the empirical part of this work

There are several important caveats that need to be made. First of all, the very design of the theory and the complexity of the resulting pattern that needs to be found seems to limit its application to the analysis of one particular episode at a time. This, in its turn, further limits the application of econometric methods to verifying whether the theory holds water empirically.

The second caveat is that no matter how systematic the guide to the empirical application of the theory to historical episode becomes, it is not possible to completely outline all the possible branchings that the empirical analysis could take, all the scenarios and all the types of the indirect evidence that can be used in order to verify the usefulness of the theory in each instance of application. This does not have to be a downside of the theory, though. One of the fundamental insights of the economists of the Austrian school whose tradition this work develops is that the economic reality is very complex and complex in a dynamic sense. The latter means that there can be mutual feedbacks among various factors involved playing out in real time. It is difficult to give an exhaustive list of the possibilities.

Adding to this, it has to be acknowledged that no boom and bust episode will involve just a sea of economic normality with the island of ABCT-described malinvestments in the middle of it. Credit expansion that may create the latter may also, for instance, serve as a form of subsidy for certain kinds of activities. Both of the aspects may be present in particular historical episodes, and if the subsidy is significant enough, its reversal may create crisis effects on its own, especially when it is accompanied by other factors. This may result in the need to attempt to distinguish the effect of the cluster of malinvestments from that of the withdrawn subsidy.

In addition, in an open economy, economic troubles may to a certain extent arrive from abroad. For instance, an economic crisis in other countries who are major importers of the goods from the country in consideration may lead to lower demand for some of its exports and reduce its output in this way, as well as the ability of some companies to import the inputs they may need for their production.

Another major way in which other factors may complicate the process of demonstrating that the candidate pattern of investments and price movements is the one described by ABCT and that it was a major factor in the crisis at least at the first stage, is that modern governments often respond to economic crises in ways that tend to exacerbate them, sometimes arguably making them far worse than they would have been if the governments in question had just allowed the entrepreneurs to adjust the structure of production to the realities of the recession and the need to reallocate resources to more valuable uses.

A further important qualifier that needs to be made is that the identification of any element of the ABCT-described pattern in a particular episode is, to a certain extent, contingent on the identification of the other elements. For instance, even if a highly time-concentrated boom in investment into nonresidential structures is identified, to verify that it is describable in ABCT terms, one needs to identify plausible contested goods, however, their identification, in its turn, hinges on whether they were utilized by the candidate excessively long projects.

Perhaps the most serious caveat to the empirical part of this work is that in virtue of the qualitative nature of the theory, the approach to its empirical validation admittedly contains some statements that are relatively imprecise in nature. For instance, determining whether certain goods in a given historical episode qualify as candidate contested requires that their prices undergo considerable appreciation at least most of which takes place with a lag with respect to the appearance of the cluster of excessively long projects. The price appreciation must be unusual compared to the past prices of these goods and/or the behavior of other intermediate good prices over the relevant boom period, which are also relatively imprecise criteria.

The avenues for rectifying this weakness in the future research with regard to the U.S. Great Recession may involve a survey of the executives involved in the undertaking of the candidate excessively long projects in order to try to see whether the errors of the kind envisaged by the theory were committed and estimate the potential weight of the candidate contested goods in the financial difficulties faced by the projects that failed or came on the verge of failing as in the case of CityCenter as opposed to the falling prices of collateral under the relevant ADC loans. A more detailed analysis of the U.S. steel market may be needed to attempt to determine how much the added demand from the cluster of nonresidential construction projects influenced the US steel prices.

Potential practical implications

Finally, it seems a matter of interest to discuss the potential practical implications of this work. To start with, if its core conclusion that expansionary monetary policy may plausibly lead to the appearance of clusters of unsustainable excessively long projects, if enough artificially

created credit is allocated to them, the straightforward implication is that monetary policy-makers may need to consider very carefully the theoretical benefits of attempting to provide economies with liquidity following recessions or in periods of relative economic sluggishness compared to the risks of creating ABCT-described booms and busts.

In addition to this, it may potentially be possible based on this research - although the prospects of this are far less clear – to develop practical guidelines for major banks, potential contested good suppliers and potentially excessively long project originators, especially of the stature of the City Center project mentioned in the Preamble that could help them to avoid or reduce the mistakes to which expansionary monetary policies make them more susceptible. For instance, when deciding which prices of their intermediate product to propose to major investment projects, potential contested good producers may be recommended to consider the timeline of the demand for the product over the lifetime of the relevant investment projects. In case the demand is set to increase substantially at some point, they may then attempt to envisage what will happen if such an increase in demand clashes with the demand coming from the other uses of their product.

Potential avenues for future research

The work contained in this volume is, admittedly, of a rather preliminary or sketchy nature, primarily due to the fact that, while it loosely follows the tradition of the Austrian School of Economics, it fleshes out an essentially novel approach to both theory formulation, use of formalization tools, and the juxtaposition of the theory to the empirical reality. The following subsections contain a brief outline of the avenues of the future research related to these three aspects.¹¹²

Further development of the theory

¹¹² It goes without saying that the list of potential refinements is far from exhaustive.

It may be argued that the part of this volume concerning the reformulation of ABCT is the best-developed one. Still, this does not mean that the theory does not require further development and refinement.¹¹³

One way in which the theory may need further refinement is through the consideration of the possible effects of the increased wages of the employees involved in the excessively long projects on the scenario proposed by the theory. This is an important consideration that was omitted from this work. Other labor-related effects of the ABCT-envisaged pattern will probably also need to be considered, as was already noted above.

Another issue concerns the more detailed analysis of the potential interactions among the various excessively long projects constituting the cluster envisaged by ABCT. It was already mentioned here that provided that a large part of the excessively long projects share relatively the same schedule of the usage the contested goods, they may at some point exert significant enough pressure on the contested good prices on their own to put some excessively long projects into trouble. However, there are other potential interactions among the excessively long projects (especially if there are identifiable large sub-clusters that are started with a substantial lag) that may be worth elaborating upon.

It may also be considered to what extent the excessively long projects within the ABCT-envisaged cluster have to utilize all the contested goods or only some of them, and what branching of the potential sub-scenarios the various possibilities may entail. The empirical analysis in this work was greatly simplified by the fact that there was an outstanding candidate for the contested good but this may not be the case for all the past or future business cycle episodes to which ABCT may be applicable.

Finally, it is worth reiterating that the theory developed here is to a very large extent a theory of the boom and the initial stage of the crisis caused by the troubles faced by the originators of the excessively long projects. However, it is implausible that the effects of the excessively long project cluster must necessarily work themselves out by the end of the initial stage of the crisis or at least become insignificant compared to other effects. One aspect for which they may be

¹¹³ This section does not contain all the possible avenues for future research some of which are mentioned explicitly in other parts of this volume or may be implicit in some contexts.

significant is the nature of the recovery from the economic crisis. For instance, it may matter whether and to what extent the troubled excessively long projects trap capital goods, whether they affect the banking sector's ability to maintain lending to consumers and businesses to a significant degree and so on.

Potential refinements to the agent-based computer model illustration

As was mentioned in chapters 2 and 3, the agent-based computer model presented in this volume is highly simplified. In particular, it only contains the explicit core elements of the theory, it does not consider the rest of the economy, it has only one excessively long project and one contested good and so on. It may, of course, be made more complex in the future to provide a higher dose of realism.

The ways in which the model can be developed further involve, for instance, through the creation of several banks competing for financing several more projects of which LTP is the longest one, the introduction of a central bank that gives one of the banks excess credit. The consumers may be associated as employees with particular producers paying them wages, the effects of their receiving wages may be added. They may also be made to save some money and put it on deposits with the banks.

It may also be possible to include more fine-grained preference structures for agents to make their actions less ad-hoc. For instance, the way IG2Producer responds to the increase in IG2 production cost in the first scenario of the model is rather ad hoc. It slashes the production of IG2 by 200 units but there is no function in place, yet, that would rationalize the choice of that particular number.

Finally, the model may be extended to encompass a whole economy and to show how the abandonment of the excessively long project (LTP) leads to an economy-wide crisis, at least in the sense of the temporarily reduced GDP. In this volume, however, the purpose of the model was merely to test the coherence of the core logic of how excessively long projects could initially seem viable but turn out to be incompatible with the underlying plans later because of the unexpectedly intensive competition from the closer-to-consumption projects. It is also possible to add an attempt

by the contested good producer to increase its production capacity in response to the increased competing demands from the closer-to-consumption projects and the excessively long projects that face financial difficulty since the originators of the latter are unable to pay the higher contested good price on the expectation of which the relevant investment is predicated.

The future versions of the model may also help guide the further development of the theory itself in line with the concerns raised in the preceding section and potentially in other ways. It may, for instance, be possible to use more complex versions of the computer model to gauge the potential interactions among the various projects within the cluster.

Bolstering the empirical findings

The empirical findings summarized in chapter 5 may also be bolstered in the future in several ways. First, it is potentially possible to find publicly available information with regard to the particular major projects like CityCenter that were part of the hypothesized ABCT-envisaged cluster during the run-up to the Great Recession.

Another important question that the analysis in chapter 5 does not allow answering is whether the rise in steel prices was truly sufficient to put a large part of the non-residential construction projects into trouble by late 2008. Answering this question would require a much more detailed consideration of the typical construction projects involved and their cost structure.

Potentially the most important improvement upon the empirical part of this work may be achieved if it were possible to conduct a survey of some of the decision-makers responsible for undertaking and financing the nonresidential construction projects discussed here. It could provide much stronger and more direct evidence for judging whether ABCT actually explains the troubles that those projects and the banks that financed them largely via ADC loans clearly faced.

The element the evidence for which requires significant further research is contested goods. Out of the two intermediate goods that appear to be plausible candidates for this role (steel components and flat glass), only steel components were studied in detail to see if their price dynamics may have been caused by the cluster of non-residential construction projects. The

analysis has demonstrated that more research into the determinants of steel product prices in the US in the period is needed. Presumably, the same caveat also applies at least to aluminum products, given that aluminum is also a globally highly-demanded commodity. In addition to this, given the constraints of this work the issue of closer-to-consumption projects was only briefly touched upon when it was noted that the phase when non-residential construction spending reached its peak coincided with a stagnation and then decline in investment into transportation equipment.

One important issue mentioned in chapter 2 that was not considered in this chapter was the performance of the potential contested good suppliers, in this case, steel component producers and potentially, flat glass manufacturers. When outlining the theory, it was hypothesized that the contested good producers may initially attempt to accommodate the increased demand for their product by investing into production expansion, only to find part of the customers unable to pay the higher prices because of the unsustainability of their excessively long projects. However, the aforementioned fixed investment data provided by BEA do not suggest that the U.S. steel industry undertook additional investment into equipment or structures at the scale that would merit consideration in terms of its impact on the wider economy.

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