IS THE STUDY OF BUSINESS-CYCLE FLUCTUATIONS "SCIENTIFIC?"

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The study of macroeconomic fluctuations assumes that the behavior of the whole (aggregates) cannot be reduced to the sum of the parts (agents, markets). This is because interdependencies between markets can substantially amplify, or on the contrary dampen, shocks that at any time disturb the equilibrium. The understanding of general-equilibrium effects, on which direct evidence is limited, which are empirically blurred by multiple potential confounding factors, and for which controlled experiments are almost impossible to design, is necessarily more conjectural than the study of individual behavior or of a specific market. However, ignoring these effects because they do not have the same degree of empirical certainty as a directly observed microeconomic effect can lead to serious policy mistakes.

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Business-cycle macroeconomics has been the subject of much criticism in recent years, to the point that it is often perceived from the outside as a field in an irremediable state of crisis[1]. I will focus here on the criticism, or rather the cluster of criticisms, potentially the most destructive, which consists of questioning the mere "scientificity" of business-cycle macroeconomics, not only with regard to other sciences (criticism which, whatever one thinks about it, is old) but in light of the recent evolution of the economics itself, especially as regards its closer relationship to data. There are two main sides to this general criticism:

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1. See, for example, Reis (2017) or Romer (2016). Much of this criticism predates the Great Recession, though the latter has contributed COMPLETE.

— The study of macroeconomic fluctuations would not have achieved the "empirical turn" characteristic of mature disciplines, even though examples of such a turning point are numerous in related fields such as labor economics, development economics, as well as in many areas of microeconomics such as industrial organization or corporate finance. Having missed this empirical turn, business-cycle macroeconomics would still consist of speculating on plausible causalities, conjectures, imaginary worlds that are potentially far removed from the one in which we live;

— Moreover, and this is partly a variation of the previous point, the theory of macroeconomic fluctuations would face an almost insurmountable problem of falsification: to the extent that too few data is available to choose among too many macroeconomic models, the stock of available models supposedly accumulates without limit over time without any effective sorting taking place. To borrow Noah Smith's expression, macroeconomists would tend to "cover all the bases" (Buchanan and Smith, 2016), demultiplying models and their associated sets of assumption indefinitely, instead of selecting a small number of relevant models.

These criticisms are severe, but are they truly justified? In any case, they do not seem to take into account an essential dimension of the study of fluctuations, which distinguishes it from other fields of economics: the importance it attaches to the strategic interactions between agents as well as to the general-equilibrium effects that take place across different markets. This is what makes macroeconomics in general, and business-cycle macroeconomics in particular, truly special: it is based on the mere notion that the behavior of the whole (macroeconomic aggregates) cannot be reduced to the sum of the parts (the agents, the markets). This is because the various interdependencies between agents and between markets can substantially amplify, or on the contrary dampen, shocks that at any moment disturb the equilibrium. The understanding of strategic interactions and general equilibrium effects, on which direct evidence is limited, which are empirically blurred by multiple potential confounding factors, and for which controlled experiments are almost impossible to design, is necessarily more conjectural than the study of individual behavior or of a specific market. However, ignoring these interdependences on the grounds that we cannot reach about them the same

degree of empirical certainty as about an isolated microeconomic mechanism would not only prevent us from understanding certain complex and large-scale phenomena (such as the "Great Recession"), but can also lead to misguided economic policy recommendations. In what follows I develop these two points by relying on a critical discussion of the recent literature.

1. Strategic Interactions and General Equilibrium Effects: Between Amplification and Dampening of Aggregate Shocks

In most cases, we do not observe a "macroeconomic shock" that alone can explain the extent of an economic crisis. The Great Depression of the 1930s was preceded by a modest stock market crash, of which no one could have anticipated the effects. The Great Recession that followed the 2008 crisis followed a major financial shock but was quickly contained by the concerted action of the major central banks; this shock alone cannot explain the depth and duration of the Great Recession, even in the United States. More generally, we do not have direct evidence of large shocks along the business cycle that alone could explain its amplitude. If production and employment vary so much over the business cycle, it must be that the economic system contains the seeds of its own instability, by amplifying the impact of small disturbances. Such amplification mechanisms are difficult to identify empirically because they generally involve several mechanisms simultaneously set in motion and generate co-movements of all macroeconomic variables. Understanding such intricacies is usually impossible without a fully specified general-equilibrium model, which explains why business-cycle analysis gives a prevalence to macroeconomic theory over a more inductive, empirical approach. Let me illustrate this point using the main three propagation mechanisms that have be argued to have contributed to the depth and duration of the Great Recession.

1.1. The liquidity trap and the deflationary spiral

The liquidity trap is defined as a situation in which the abundance of reserve money within the banking system causes the nominal interest rate on the interbank market to fall to the level of the interest rate on the excess reserve that private banks hold on their account with the central bank. This occurs precisely when the central bank is attempting to implement the maximum level of monetary accommodation, so in a

situation where the interest rate on reserves is itself kept close (and potentially slightly below) the rate of return on bank notes, namely zero (abstracting from the cost of storing bank notes). At this point "conventional" monetary policy becomes inoperative and any macroeconomic shock is magnified by the deflationary spiral depicted in Chart 1: a falling aggregate demand depresses output and inflation; at a given nominal interest rate, these deflationary pressures cause a rise in the real interest rate, thereby reinforcing the initial fall in aggregate demand, and so on. This feedback loop has been the subject of a large literature since the pioneering contribution of Krugman (1998) and is today one of the main explanatory model for the depth and duration of the Great Recession in the United States and the euro area.[2]

Chart 1. The liquidity trap and the deflationary spiral

Low future inflation

High real interest rate

Negative shock

Low current inflation

Low output
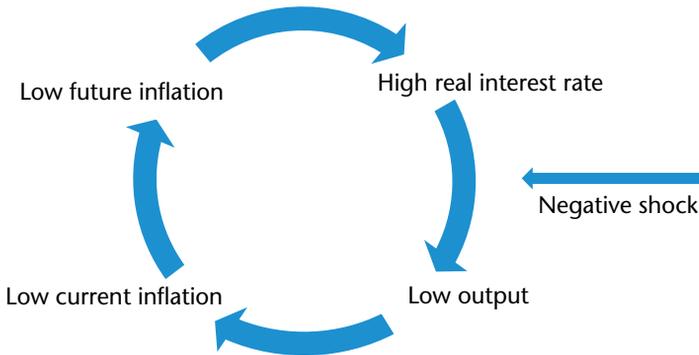
The deflationary spiral depicted in Chart turns out to be particularly difficult to directly measure empirically – far more than the effect of limited disruption in a particular market. This spiral involves a number underlying macroeconomic blocs (the Phillips curve, the Fisher relation, demand-determined output), each of which with its own identification challenges. Given the inherent complexity of the economic mechanism at work, attempts at empirically evaluating this deflationary spiral have essentially adopted one of the following approaches:

— The first approach is to test a specific implication of the propagation mechanism under consideration, which clearly distinguishes

2. See, for exemple, Eggertsson and Krugman (2012), Christiano *et al.* (2015), and Gust *et al.* (2015).

it from alternative propagation mechanisms. In the present context, the so-called paradox of toil (Eggertsson, 2010), according to which negative supply shocks become expansionary in a liquidity trap (because of their inflationary impact), provides the needed crucial experiment.[3] In this spirit, Wieland (2017) rejects the liquidity trap hypothesis by showing that negative productivity shocks (earthquakes, oil price shocks) are contractionary even at the zero lower bound. In contrast, Datta *et al.* (2017) find strong co-movements between oil and equity returns at the zero lower bound, which is supportive of the liquidity trap hypothesis. Even if the issue is not yet empirically settled, it remains that the impact of supply shocks at the zero lower bound provides a clean test of the feedback loop described in Chart 1.

— The second approach is to specify a complete general-equilibrium model, in which the deflationary spiral mechanism is present, and then to estimate it empirically (see, for example, Christiano *et al.*, 2015, Gust *et al.*, 2017). This approach makes it possible to measure the full causal chain postulated by the theory and potential then to build alternative scenarios ("counterfactuals") which describe how the economy would have behaved if this causal chain had been broken (say, if the bank central could have implement very negative interest rates).

It is clear that in both cases economic theory plays a preponderant role. In the first case, a complete dynamic general equilibrium model is necessary to formulate a testable implication of the considered mechanism; in the second, the full same model (potentially augmented with addition features) is itself estimated on historical data. In any case the deflationary spiral does not spontaneously show up in macroeconomic time-series: it is primarily a theoretical construct and therefore, from the outset, an interpretation of these time-series.
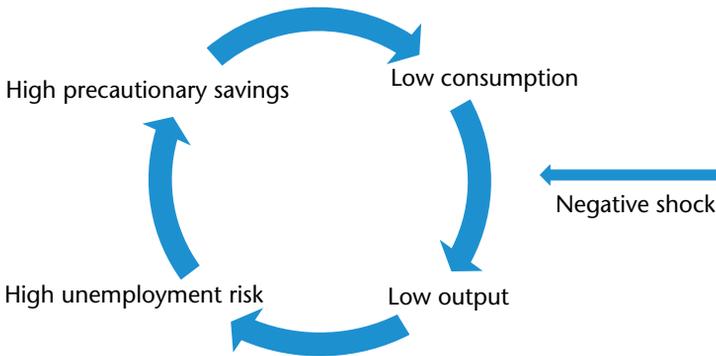
1.2. The precautionary-saving feedback loop

A second amplification mechanism, which can play simultaneously or independently of the previous one, involves the precautionary saving

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3. Eggertsson (2010) introduced the paradox of toil by studying the impact of labor supply shocks on equilibrium employment in a liquidity trap (he showed that a positive labor supply shock could actually lower employment, due to the inflationary impact of the shock on nominal wages and prices). Since then the same expression has been used to qualify the paradoxical effect of any supply shock on output in a liquidity trap.

behavior of households and the way in which it interacts with unemployment risk over the business cycle. This spiral is summarized in Chart 2. Intuitively, a fall in output that causes employment to fall back raises households' precautionary savings (in anticipation of the increased risk of unemployment); the induced fall in aggregate demand reinforces the initial drop in output and employment, increases the risk of unemployment, and so on. This spiral involves three basic mechanisms. First, output must respond in one way or another to aggregate demand (for example because nominal prices are sticky). Second, labor-market flows and the unemployment risk that they generate must respond endogenously to output changes; this requires a representation of the labor market in terms of worker flows (between employment and unemployment) and not simply in terms of stock (employment). Finally, and perhaps most importantly, households need to be imperfectly insured against the risk of unemployment – otherwise there would be no precautionary motive in the first place and therefore no time-variations in precautionary savings. These three mechanisms are present in various forms, and thus generate the precautionary-saving spiral, in the works of Challe *et al.* (2017), Chamley (2014), Den Haan *et al.* (2017), Heathcote and Perri (2017), Ravn and Sterk (2017) and Werning (2015), among others.

Chart 2. The precautionary-saving feedback loop

Empirically measuring the feedback loop depicted in Chart 2 is, again, challenging. Quantitative assessments of the precautionary-saving spiral require from the outset the formulation of a complete dynamic general-equilibrium model in which the three ingredients

described above are introduced. Ravn and Sterk (2017) calibrate such a model, paying particular attention to the dynamics of the labor market. Challe *et al.* (2017) propose a structural estimation of a related model in order to evaluate the amplifing role of the precautionary motive during the last three recessions in the United States. As far as I know, there is no crucial experiment (of the kind of the paradox of toil in models of the liquidity trap) that would make it possible to directly test the existence of the precautionary-saving spiral: when one departs from the structural estimation of the full general-equilibrium model, only indirect evidence about a particular dimension of the loop is available (relating, for example, to the effect of fluctuations in employment on consumption demand). Thus, just as in the case of the liquidity trap, the precautionary-savings spiral is a plausible propagation mechanism, the amplitude of which can be measured in the data *only through the lens of a fully-specified general-equilibrium model*. For this reason, the precautionary-saving spiral is best understood a particular way of interpreting the joint dynamics of aggregate demand and unemployment during a recession, which can (and should), be confronted (and possibly associated) with alternative plausible amplification mechanisms.

Note that the work on imperfect insurance and the precautionary motive fully integrates individual heterogeneity into macroeconomic dynamics, recognizing from the outset that different households (in terms of wealth, income, labor market perspective etc.) behave differently, notably in terms of consumption and asset accumulation choices. In particular, a typical result in this literature is that poorer households (that is, households that are close to their own debt constraint) have an individual consumption response to macroeconomic shocks that is stronger than that of richer households, and hence their presence is more likely to set in motion the precautionary-saving feedback loop described in Chart 2. This approach makes it clear that the amplitude of the business cycle and the level of inequalities within a particular economy are fundamentally intertwined. For this reason, this approach allows studying some important economic policy issues that can not otherwise be addressed. Among those issues are the aggregate demand effects of redistributive policies (through taxes or unemployment insurance), which is the focus of the recent work of McKay and Reis (2016, 2017).

1.3. The credit cycle

A third feedback loop, which is thought to have played an important role in the propagation of the Great Recession, is the so-called "credit cycle" depicted in Chart 3. The modern formulation of the credit cycle dates back to Kiyotaki and Moore (1997). The theory was later on operationalized into an estimated DSGE model by Iacoviello (2005), who focused on the joint fluctuations of credit and house prices. More recent contributions such as Jeanne and Korinek (2010) have looked more closely at the welfare impact of the feedbackloop. This line of works points out to the fact that fire-selling assets during a crisis entails a negative externality, since the implied fall in asset prices tends to tighten the credit constraints of all the other agents - thereby making them more likely to also sell their own assets. As a consequence, a benevolent policymaker may be willing to restrict agents' borrowing ex ante in order to limit the risk of fire sale. This theory provides one possible justification for imposing a "macroprudential" regulation, in addition to the more traditional banking regulation.

Chart 3. The credit cycle
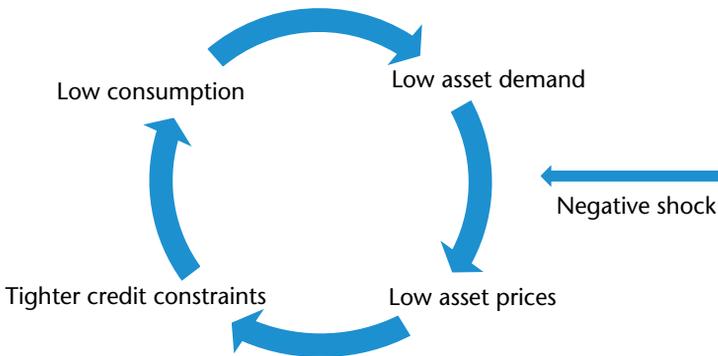
1.4. General-equilibrium dampening of aggregate shocks

The discussion above illustrates the fact that general-equilibrium feedbacks can dramatically amplify the impact of "small" aggregate shocks, and stresses that such feedbacks can only be measured in the data by means of a theoretical model that incorporates them in the first place. But it is worth stressing that general-equilibrium effects do not necessarily manifest themselves through amplification: they can

equally *dampen* the impact of aggregate shocks, relative to what a naïve partial-equilibrium analysis (holding prices constant) could suggest. To illustrate this, let us push the line of argument of Angeletos (2018). Angeletos (2018) wonders what classes of models can rationalize the Keynesian narrative that low aggregate demand can depress output. To frame the discussion in modern language, suppose that individual consumers suddenly value current consumption less than future consumption (say, marginal utility falls exogenously relative to future marginal utility). Holding prices constant, and aggregating over all consumers, this preference shock must translate into lower aggregate consumption demand, hence it is indeed a "negative demand shock". In a partial equilibrium setting with constant prices, this would translate into lower consumption. But prices cannot be considered constant in general equilibrium. As stressed by Angeletos (2018), in a Real Business Cycle model the drop in consumption generates an equal rise in savings and a fall in the real interest rate that boosts investment demand. Now let's take this reasoning one step further and assume that output uses labor only, so that there is no demand for capital on the part of firms. Still, if markets are complete households can potentially trade bonds between themselves, instead of lending capital to firms. But someone needs issue the bonds that the savers are willing to purchase, and no household hit by a negative marginal utility shock is willing to borrow. In general equilibrium, the (shadow) price of bonds must fall until households are again happy consuming the very same level of consumption that was planned before the marginal utility shock occurred: general-equilibrium adjustments in relative prices have completely eliminated the partial-equilibrium effect of the consumption shock. Of course, aggregate demand and output may fall after a consumption shock if prices are sticky and output is demand-determined; in this case actual output may fall below natural output, which is formally equivalent to a rise in monopolistic distortions (Woodford, 2003). But here again, endogenous price adjustments, even muted, tend to reduce the direct (partial-equilibrium) effect of the consumption shock, except in the extreme case of constant nominal prices.

To summarize, partial-equilibrium intuitions or empirical evidence are uninformative about the likely effects of aggregate shocks, since we should expect those shocks to be amplified (due to strategic complementarities and feedback effects) or buffered (due to endogenous price adjustments) or both at once.

2. What Lessons for Macroeconomic Policy? The Example of Fiscal Multipliers

The importance of general-equilibrium effects implies that the impact of alternative macroeconomic policies cannot generally be estimated simply by extrapolating measures, however precise, based on "small", local policy shocks. The recent debates on the size of the fiscal multipliers, and notably the government spending multiplier, illustrate this point and deserve further discussion.

Formally, the government spending multiplier is defined as the growth in GDP induced by an exogenous increase in government spending scaled by GDP before the policy change. The empirical literature on this multiplier is considerable. Its main challenge is to measure the causal effect that goes from public expenditure to output, while many other mechanisms may affect the empirical correlation between these two variables. To make this point clear, imagine that government spending has no causal effect on output whatsoever. However, government spending varies systematically with output since it is higher in recession than in expansion (due to the automatic stabilizers), hence there is a reverse causality going from output to government spending. The endogenous response of government spending to output induces a negative correlation between these variables that can be wrongly attributed to a causal effect running from expenditure to ouput. In practice causality goes both ways, and moreover a number of confounding variables may correlate government spending and output independently of any causal link. In this context, how can one isolate the variations in government spending that are truly exogenous, in order to measure their causal effect on output?

The recent empirical literature has mostly relied on two distinct identification strategies to answer this question. The first strategy is to focus on a particular type of government spending shocks that are arguably not themselves caused by changes in GDP. The most common way to proceed is to consider as exogenous shocks the increase in military expenditure due to sudden, unanticipated deteriorations of the geopolitical context. These events generate variations in public spending that do not depend on the business cycle (although the cycle depends on it) and thus constitute in principle a valid basis for measuring the public spending multiplier. The multipliers obtained using this method vary between 0.8 and 1.2 for the United States (Hall, 2009, Ramey, 2016).

A second approach to estimating the causal effect from public spending to output relies on variations in local public expenditures to average out their nation-wide component. The study by Suarez Serrato and Wingender (2016) provides a particularly telling illustration of this approach. Every ten years, the population of the United States is counted, so that the recorded population of each county changes. Following this, the federal government adjusts its financial allocation to adjust to these demographic changes: the counties whose population is revised upwards see their endowment increase, and those whose population is re-evaluated downward see it decrease. Unsurprisingly, this reallocation of federal funds between counties gives rise in each county to a variation in local public expenditure. By construction, these local variations are orthogonal to variations in US GDP as a whole as well as to other economy-wide factors (e.g., monetary policy) that are systematically related to GDP. Variations in local output generated by local variations in public spending thus form a valid basis for computing local spending multipliers. The authors find local multipliers close to 2, thus significantly higher than those obtained using macroeconomic data. The other studies adopting a similar approach also find high values of the multiplier, around 1.5.[4] In summary, the empirical literature on the public spending multiplier gives (for the United States):

— "nationals" multipliers between 0.8 and 1.2;

— "local" multipliers between 1.5 and 2.

From a strictly empirical point of view, the estimation of local multipliers has two advantages over that of national multipliers. First, the exploitation of geographical disparities in public expenditure eliminates by construction any effect of the aggregate business cycle on public expenditure, which in principle offers a more reliable identification strategy than those based exclusively on macroeconomic data. Second, local multipliers tend to be more precisely estimated, partly because they make use of a much larger set of data.

One question that naturally arises is the reliability of these multipliers in terms of *macroeconomic* policy. Indeed, by their very nature, the spending shocks under study are of low amplitude, and partly offset each other from one region to another. Therefore, it is unlikely

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4. See, for example, Acconcia *et al.* (2014) and Nakamura and Steinsson (2014), as well as Fuchs-Schuendeln and Hassand (2016) for a survey.

that these shocks will trigger the potentially powerful general-equilibrium effects of a large-scale shock at the level of a country as a whole. These general-equilibrium effects of public spending shocks have ambiguous consequences on the size of the multiplier: they can either lessen the direct microeconomic effects of the shock (for example, if the public expenditure shock is associated with a rise in the real interest rate, which reduces private expenditure), or instead amplify them (if for example one of the amplification mechanisms described in the previous section are set in motion). For the reasons explained above, we should expect both amplification and dampening effects to be simultaneously at work, leading them to partly offset each other. Unfortunately, this implies that local spending multipliers are of little help, on their own, in assessing the likely effect of a macroeconomic stimulus package – the ultimate question of interest.

Does this mean that local multipliers are of no interest to macroeconomists? Not so. As shown by Nakamura and Steinsson (2014) even if they do not directly inform us about the size of the aggregate multiplier, local multipliers (which they more accurately refer to as the "open-economy relative multipliers") offer a powerful way of evaluating alternative macroeconomic models. For example, under the New Keynesian model, the size of the economy-wide public spending multiplier is conditional (like any fiscal policy) on the response of monetary policy: a strict targeting of inflation can lead the central bank to raise the real interest rate (*via* an increase in the path of policy rates) following a government spending shock, with the effect of reducing the observed fiscal multiplier; in contrast, a more accommodative monetary policy response would reinforce the expansionary impact of the fiscal stimulus. In as much as local multipliers are independent of economy-wide monetary policy, the alternative models make unambiguous predictions as to the size of their relative open-economy multipliers, which can then be compared to their empirically estimated counterparts. Nakamura and Steinsson show that this exercise leads to the rejection of the neoclassical Real Business Cycle model in favor of the New Keynesian model, which turns out to imply a much larger closed-economy aggregate multiplier. Their analysis makes it clear that it needs a fully specified macroeconomic model to turn estimated local multipliers into a policy-relevant, economy-wide government spending multiplier.

3. Concluding Remarks

In a letter to Harrod in 1938, in response to his presidential address to the Royal Economic Society, Keynes discusses the nature of economics in these terms:

> "It seems to me that economics is a branch of logic, a way of thinking; and that you do not repel sufficiently firmly attempts à la Schulz to turn it into a pseudo-natural-science. [...] Economics is a science of thinking in terms of models joined with the art of choosing models which are relevant to the contemporary world" (J.M. Keynes, Letter to Harrod, July 4, 1938).

We cannot better summarize what remains an essential characteristic of the study of business cycles and crises, namely the primacy of economic theory over empirical analysis. This remains true today even though the relationship between theory and data (and, more recently, micro data) is much tighter than when Keynes wrote these lines. This primacy of the theory makes the discipline necessarily more conjectural than other fields of economics, because statistical inferences are always conditional on relatively complex general-equilibrium models whose relative performance is difficult to evaluate. This is not a lack of scientificity, but rather the way in which the scientific approach manifest itself in this field of investigation.

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