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What are stylized facts?

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Economists use the term 'stylized fact' in many contexts, though the meaning of this phrase and the motivation for using such a concept is unclear. In this paper, we provide a philosophical analysis of stylized facts, which aims to be methodologically interesting and useful. While our framework applies to all principled uses of stylized facts, we illustrate its core features by applying it to Nicholas Kaldor's initial and exemplary use of stylized facts in growth economics.

[AQ2] **Keywords:** stylized fact; Kaldor; methodology

Economists use the term 'stylized fact' in many different contexts. Talk of stylized facts can be found in discussions of growth (Easterly & Levine, 2001; Jones & Romer, 2009; Kaldor, 1961; Loayza, Fajnzylber, & Calderón, 2005), business cycles (Fiorito & Kollintzas, 1994; Harvey & Jaeger, 1993), development (Palma, 2008; Rodrik, 2007), financial economics (Cont, 2001; Guillaume et al., 1997), and other fields. Stylized facts [AQ3] also are used in a variety of contexts, such as benchmarks for calibration exercises in RBC models and theoretical simplifications for model building. But what exactly *are* stylized facts? And what are they good for?

In answering these questions, economists exhibit a wide spectrum of opinions. Solow (1970, p. 2) famously quipped that, 'There is no doubt that they are stylized, though it is possible to question whether they are facts,' and in a similar (but more charitable) vein, some philosophers have taken them to be useful fictions (Elgin, 2004). By contrast, others seem to think that stylized facts are no different than other economic facts, and tend to puzzle over the sense in which they are 'stylized.' For instance, Boland (1997, p. 245) writes:

> The only methodological problem that might arise when purporting to explain stylized facts and the situation that they define is the potentiality of circular argument.

Of course, when purporting to explain *any* fact (stylized or otherwise), economists should avoid circularity, so if this is the only methodological problem that arises in the context of stylized facts, then, as Boland recognizes, the notion of 'style' is trivial.

The preceding might suggest that something can either be stylized (in a nontrivial sense), or be a fact, but that it cannot be both. In this paper, we offer a philosophically informed analysis of stylized facts that belies this dilemma. Our primary goal is to offer a framework that can provide methodological advice as to when and where economists should stylize their facts. Thus, our aim is not descriptive, for we do not aim to find some common core to the different ways that economists use the term 'stylized fact.' Instead, we illustrate the fruitfulness of our framework by applying it to one of the most widely

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heralded uses of stylized facts: Kaldor's (1961) baptism of the term in his discussion of economic growth. However, we stress that this is only one application, and that our view is applicable in virtually any economic domain (and beyond). Thus, our interest in Kaldor exegesis is only insofar as it assists in providing a general and methodologically fertile account of stylized facts.[2]

We first present Kaldor's stylized facts (Section 1). We then introduce a 'baseline' by which to contrast stylized facts, what we call 'bare facts' (Section 2). Then we provide our general account of stylized facts (Section 3). We apply this framework to Kaldor's early work (Section 4), and then conclude with the broader ramifications of our general framework (Section 5).

1. Kaldor's stylized facts

The most famous stylized facts were the first ones so dubbed by Nicholas Kaldor. Indeed, they are now canonized as 'Kaldor facts.' Throughout this essay, these stylized facts shall be our primary focus, though our framework is broad enough to cover all kinds of methodologically interesting stylized facts, and we briefly discuss other stylized facts in the conclusion.

Kaldor facts purport to describe long-term economic growth. Consider an economy that produces output (Yt) over time using capital (Kt), labor (Lt), and technology (At). For simplicity, we will assume that the production function that combines these factors is a Cobb–Douglas production function of the form: $Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$, where α, $1 - \alpha$ are the shares of capital and labor, respectively.[3] When looking at per capita variables, we will use lower case letters, for example $y = Y/L$. The returns to factors of production, capital and labor are the interest rate (r_t) and the wage (w_t). The subscript t indicates the temporal dimension of these variables. All Greek letters correspond to constants, and for all variables x, g_x denotes x's growth rate. Economic growth, according to Kaldor, exhibits these characteristics:

KF1: Per capita output grows over time $gy > 0$
KF2: Capital per capita grows over time $gk > 0$
KF3: The rate of return to capital is constant $r - \delta = \theta$, where δ is the depreciation rate.
KF4: Capital to output ratio is constant $K_t/Y_t = \gamma$
KF5: Factor shares are constant $r_t K_t/Yt = \alpha$ $w_t L_t/Y_t = 1 - \alpha$
KF6: Per capita growth rates differ among countries.

Why are these considered *stylized* facts? When Kaldor (1961, p. 178) first introduced them, they were hedged as follows:

> Since facts, as recorded by statisticians, are always subject to numerous snags and qualifications, and for that reason are incapable of being accurately summarized, the theorist, in my view, should be free to start off with a "stylized" view of the facts – i.e. concentrate on broad tendencies, ignoring individual detail, and proceed on the "as if" method, i.e. construct a hypothesis that could account for these "stylized" facts, without necessarily committing himself on the historical accuracy, or sufficiency, of the facts or tendencies thus summarized.

The Kaldor facts' fate in subsequent economic practice has been mixed. For all but KF3, subsequent economic research has provided empirical support for these claims (Barro & Sala-i-Martin, 2004, pp. 12–16), with the major 'snag and qualification' being their restriction to developed countries. Moreover, subsequent economic theorists still find these remaining Kaldor facts to be worth explaining, and endorse these facts as good starting points for their own theoretical models (Solow, 1970; Acemoglu, 2009).

In addition, with the exception of KF6, it would be misleading to say that Kaldor facts still play a central role in the economics of growth. The direction of economic growth research has moved away from proximate to deep determinants. In the early period, the economic growth literature was concerned with how labor and capital accumulation translated into long-run economic growth.[4] This trend gave rise to a large literature of 'growth accounting' to estimate the contribution of factor endowments to economic growth. The problem with this approach is that these factors are actually endogenous, i.e., it may be that growth causes factor accumulation. This issue propelled the development of the new growth theories: the interest shifted towards conditions under which this factor accumulation occurs. Labor and capital are considered correlates of growth that are influenced by growth determinants such as geography, trade, and institutions as shown in Figure 1.

2. Bare facts

In what sense are stylized facts methodologically interesting? Answering this question requires some stage setting. First, in this section, we provide a clear account of non-stylized or 'bare' facts. Roughly, bare facts (BFs) are the kinds of facts that deserve no special title, e.g. well-confirmed statements about empirical regularities that are the typical objects of economic explanation (i.e. *explananda*). In subsequent sections, we use BFs as a baseline by which to compare stylized facts. Specifically, we show that stylized facts are of distinctive methodological interest because they are methodologically different than BFs.

We offer the following definition of a BF:

(BF) A statement *p* describes a BF if and only if

(1) *p* purports to describe a phenomenon;
(2) *p* is validly inferred from reliable data; and
(3) *p* ought to be systematically explained by a theory.[5]

Let us discuss the key terms in this definition. Phenomena are features of the social and natural world that exhibit repeatable characteristics that are detectable by different procedures. To say that a statement *purports* to describe a phenomenon is to acknowledge the fallibility of science, for a statement may fail to describe a phenomenon accurately. Having said that, the second condition is intended to render such a scenario unlikely. Data are intersubjectively verifiable records produced by measurement, observation, and experiment, and unlike phenomena, they are assumed to be idiosyncratic to specific procedures. In economics, we can usually identify phenomena with populations, and data with samples. Similarly, we define reliability and validity in accordance with statistical

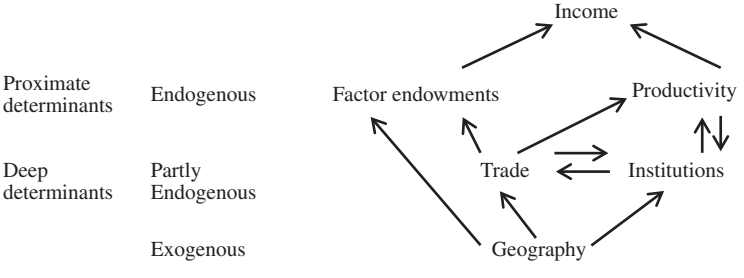

Figure 1. Economic growth determinants: proximate and deep. *Source*: Rodrik, 2003, p. 5.

conventions.[6] In other words, data are reliable to the extent that they are consistent with each other; they are valid if, in concert, they accurately measure the intended phenomena.

In saying that BFs are validly inferred from reliable data, we mean that some economist has actually done the inferential and empirical legwork. In other words, it does not suffice that these facts *could* have been inferred or the relevant data *could* have been collected. Furthermore, in the paradigmatic case, BFs are common knowledge among specialists in a field.

Let us now turn to systematic explanation. For our purposes, a theory systematically explains a phenomenon when accurate statements about different properties and states of the phenomenon can be derived from the theory's fundamental principles or assumptions. By contrast, a theory does not systematically explain the data from which a phenomenon is inferred. This is because data typically are the result of several different causal factors that have little to do with the phenomena, and more to do with the idiosyncrasies of data collection, measurement, and (where applicable) experimental apparatuses.

Importantly, BFs *are* validly inferred from reliable data, but only *ought to be* systematically explained by a theory. This is because of the epistemic differences between these two conditions. If we cannot validly infer something from reliable data, there are good (though defeasible) reasons to question whether it is a fact. By contrast, we can know something to be a fact even if we cannot provide a systematic theoretical explanation of it. (Indeed, depending on one's optimism, most economic phenomena may lack adequate systematic explanations.) Nevertheless, when we have a stable pattern that is well confirmed, it 'cries out' for explanation, which is the sense in which BFs *ought* to be explained.

Let us illustrate these ideas with an example. Following our earlier discussion, the phenomenon to explain is economic growth. Traditionally, economists measure growth using changes in real gross domestic product (GDP), real GDP per capita, or real GDP per worker. Measurement error is often a problem in developing countries, where statistical agencies lack resources and infrastructure to obtain the data required to improve accuracy and reliability. To address this issue, economists have resorted to indirect indicators such as measuring the light emanated by different countries using satellite imagery (Henderson, Storeygard, & Weil, 2012). A systematic explanation of economic growth ought to explain different aspects of GDP, but will not explain the workings of the satellite, the light emanation of different countries, or even how light emanation yields data about economic activity. That is because these are all idiosyncratic features of the data, while real GDP is actually capturing the phenomenon of interest.

3. Stylized facts

Recall that we are treating BFs as a baseline by which to contrast stylized facts. The latter are only interesting if they differ from the former. With this account of BFs in hand, we shall argue that being a BF is neither necessary nor sufficient for being a stylized fact. Consequently, stylized facts are methodologically interesting.

In one sense, stylized facts require *less* than BFs. So some stylized facts are not BFs. For instance, Kaldor's quotation from above contrasts stylized facts with the 'facts recorded by statisticians.' Kaldor suggests that stylized facts differ from these facts in that the former 'ignore individual detail.' Then one (rough) proposal is that BFs are detailed statistical descriptions, and stylized facts may lack these details.

The preceding account of BFs helps to specify what these 'details' involve. Recall that one requirement of a BF is that it may be validly inferred from reliable data. Moreover,

we suggested that in paradigmatic cases, this requirement be construed in accordance with statistical conventions. Hence, stylized facts differ from BFs in that they eschew this requirement. For ease of locution, we shall say that stylized facts face *data constraints* because they are not validly inferred from reliable data.

Importantly, some statements face data constraints, but are neither BFs nor stylized facts. The obvious examples are when scientists make mistakes, e.g. as a result of typos in a spreadsheet. Simply making these errors does not thereby stylize one's facts. Nor would hiding such errors (e.g. through intellectual fraud) suffice to stylize one's facts. Rather, the data constraints must be known and explicit.

In another sense, stylized facts require *more* than BFs. So some BFs are not stylized facts. For instance, Kaldor suggests that BFs 'are incapable of being accurately summarized,' while stylized facts are not. More generally, stylized facts must play a *methodologically beneficial role* that BFs do not play. On Kaldor's account, this role involves summarizing data. In a later essay, Kaldor (1985) also suggests that stylized facts are a 'basis for theory building.' This could also be a methodologically beneficial role that stylized facts can play. As we argue later, neither of these captures what is most methodologically beneficial about the Kaldor facts.

Returning to the big picture, we can summarize the preceding thusly:

(SF) A statement p describes a *stylized* fact if and only if:

(1) p purports to describe a phenomenon;
(2) p faces *known and explicit data constraints*, i.e. p is *not* validly inferred from reliable data; and
(3) p ought to be systematically explained by a theory.[7]

In addition, a stylized fact is *useful* if and only if it satisfies a further condition:

(4) p plays a *methodologically beneficial role* in addition to being systematically explained by a theory.[8]

Any subsequent references to 'data constraints' are elliptical for 'known and explicit data constraints.' Similarly, 'stylized facts' are elliptical for 'useful stylized facts.' Condition (2) restates the sense in which stylized facts require less than BFs; (4), the sense in which they require more. Hence, we have identified two ways in which stylized facts differ from BFs, and are thereby methodologically interesting. Let us tout the virtues of approaching things in the general manner that we have thus far, before attending to a concrete application of this framework.

First, stating things in general terms provides a universal framework for conceiving of otherwise diverse stylized facts. Specifically, there may be many different *data constraints*, i.e. many ways in which one may not validly infer a stylized fact from reliable data. For instance, there may be a lack of any data whatsoever, or there may be an abundance of data that is unreliable, or there may reliable data that faces certain inferential liabilities.

Similarly, the general approach we take here provides an umbrella under which stylized facts may play different *roles* in achieving different *methodological benefits*. For instance, a stylized fact may play different roles in theory construction, e.g. it may play a role in a fruitful analogy or it may make a previously neglected theory more salient. Furthermore, as mentioned earlier, stylized facts may promote methodological benefits other than those associated with theory construction. For example, they may also promote searches for new phenomena or new data.

While SF is our official definition of stylized facts, we highlight three further features of stylized facts – what we call *appending*, *shedding*, and *complementary triples*. First,

many (if not all) stylized facts are *transient*, i.e. they enter the scientific corpus as stylized facts, but subsequently get 'dressed down' so as to eventually become BFs. So far as we know, nobody has argued for the intransience of a stylized fact, but at any rate, it suffices for our purposes if *some* stylized facts get dressed down. With respect to data constraints, dressing down will entail *appending* to the stylized fact whatever is required to make it a BF. The process of appending consists of searching for reliable data and statistical methods that will underwrite a valid inference to the stylized fact. If necessary, appending may also require revising the statement so that it more accurately describes a phenomenon.

Second, with respect to methodologically beneficial roles, dressing down will entail *shedding* the extra requirements that distinguish stylized facts from BFs. Shedding will occur when the stylized fact no longer plays its methodologically beneficial role, and simply plays the roles that BFs play as well-confirmed explananda. So, if Kaldor's characterization of stylized facts as a basis for theory building were correct, then stylized facts that no longer spark theory building have shed their methodologically beneficial role.

Third, the most interesting stylized facts exhibit *complementary triples* of data constraints, methodological roles, and methodological benefits. In a complementary triple, these three elements stand in some arrangement of justificatory relationships. We focus on one such triple, in which the data constraints dictate a certain benefit, which in turn justifies the methodological role. In this case, the general motivation for a stylized fact is as follows:

When faced with data constraints D, it is methodologically beneficial to bring about B. Stylizing fact p plays a role R in bringing about B. So, when faced with D, it is useful to stylize p.

Other complementary triples may be possible, but we shall not explore this here. Complementary triples are desirable because they provide an 'inner logic' or 'coherence' to the use of stylized facts.

4. Back to Kaldor

Using Kaldor (1961) as our example, let us consider a detailed and concrete illustration of our approach. Before proceeding, three caveats are in order. First, we stress that this is just one application of the broader framework presented in the previous section. As should already be clear, our framework suggests many possible ways of stylizing facts. Second, our account of Kaldor's use of stylized facts bears a strong resemblance to Boland's (1987, 2008) influential account. We see part of our contribution as treating this construal of Kaldor as an instance of the broader framework discussed in Section 3. Third, space prohibits closer comparisons with other accounts and uses of stylized facts. In subsequent work, we hope to extend our framework to the other uses for stylized facts that Boland describes (e.g. 'a laying out of a commonly accepted task for the model-builder'), as well as the later Kaldor's (1985) view that stylized facts provide an inductive basis for theory construction[9].

We have seen that a stylized fact is characterized by its data constraints, methodological benefits, and methodological role. We discuss each of these, plus the complementary triple, appending, and shedding that pertain to Kaldor's use of stylized facts.

4.1. Data constraints

First, Kaldor faced data constraints. In particular, he had little data about developing countries. In his seminal paper, Kaldor only mentions two countries: the USA and the UK while only citing Phelps Brown and Weber (1953) to document the trajectory of the British

rate of profit. Looking at the literature published during those years, it is clear that no worldwide data-set on economic growth was available. According to Durlauf and Johnson (2008), Kaldor referred to the US-based study by Klein and Kosobud (1961) in relation to labor shares. Moreover, the only available data for interest and profit rates at that time is restricted to the USA and the UK. Even Bruton's (1955) essay uses data from only these two countries as a starting point for modeling economic growth in developing countries. Indeed, Bruton admits that the data were limited during this period: most of the data on GDP were published in the late 1950s by the United Nations.[10] So the evidence suggests that Kaldor's available data could have been neither valid nor reliable.

4.2. *Methodological benefits*

Despite these constraints, Kaldor's stylized facts still offered two kinds of methodological benefits. First, they provided more phenomena than the available data would license. Second, they broadened the range of theoretical options. Let us discuss each in turn.

First, although Kaldor's stylized facts could not be validly inferred from reliable data, they were nevertheless 'plausible' given the data at his disposal. While plausibility could be interpreted as a relaxed form of validity (e.g. an inference that would be valid given a higher *p*-value), there are two reasons that speak against this interpretation. First, if this is all there is to stylized facts, then they should be rejected outright for their statistical shortcomings. Second, statistical considerations play no role in Kaldor's presentation of his stylized facts. From his original article, it is clear that he did not use any statistical analysis to characterize the long-term behavior of the data.

Rather, plausibility appears to be more dialectical than data-driven. Despite their data constraints, both Kaldor and his interlocutors accepted that the stylized facts would be borne out by future research (i.e. appended with further data). This kind of dialectical plausibility is important, for if partisans of different theoretical persuasions find the phenomena to be plausible, then they are not merely theory-laden commitments. This, in turn, is what makes them worth explaining, even if they are unsupported by reliable data at the time of their inception.

This is especially useful in contexts where reliable data are scarce. In such contexts, few phenomena can be inferred from the data. Consequently, adjudication between competing theories and explanations is often underdetermined. As a result, even the best explanations may be little more than just-so stories when facing significant data constraints. By including dialectically plausible stylized facts among the phenomena to be explained, one constrains an otherwise over-permissive space of acceptable explanations.

Kaldor used this feature of stylized facts to great effect. Immediately after presenting his stylized facts, Kaldor (1961, p. 179) writes, 'None of these "facts" can be plausibly "explained" by the theoretical constructions of neo-classical theory.' In other words, even if the then-dominant neo-classical theory appeared adequate with respect to the considerations that preceded KF1–KF6, this was only because those considerations did not amount to very stringent empirical constraints.

This brings us to our second benefit. Kaldor's stylized facts allowed him to *broaden the range of theoretical options*. After highlighting the neo-classical model's shortcomings, Kaldor (1961, p. 179) writes, 'My purpose here is to present a model of income distribution and capital accumulation which is capable of explaining at least some of these "stylized" facts.' Since neo-classical theory was the dominant theoretical approach at the time, Kaldor's use of stylized facts was a means of getting other economists to consider his unique approach to economic growth. However, in principle,

any theory that can plausibly explain these stylized facts will thereby warrant greater attention.

Methodologically speaking, it is beneficial to broaden the range of theoretical options for three reasons. First, the best available explanation of the phenomena considered may only be the best of a bad lot (Stanford, 2006; van Fraassen, 1989)[11]. By broadening the range of theoretical options, one helps to mitigate this difficulty.

Second, the tendency to ignore theoretical options and phenomena recalcitrant to one's preferred theory is an instance of confirmation bias (Nickerson, 1998). As others have argued, scientists are not immune to this trap (Mynatt, Doherty, & Tweney, 1977). Consequently, expanding theoretical options is a useful correction to a widespread psychological bias.

Third, even when a previously under-considered theoretical option is considered and subsequently rejected in favor of the dominant theory, this can benefit the latter (Solomon, 2001). When such comparisons are methodologically sound, they frequently involve additional empirical tests and theoretical refinements of the dominant theory. The most immediate response to Kaldor's challenge was theoretical refinement of the neo-classical theory to explain the new facts. We discuss this in Section 4.6. In this way, Kaldor's use of stylized facts ultimately resulted in improvements to the neo-classical theory.

4.3. *Methodological roles*

Thus far, we have discussed the data constraints and methodological benefits of Kaldor's use of stylized facts. However, we have not explained how these facts provide these benefits, i.e. their role. We propose to think of this as a four-step process:

Step 1: Begin with an under-considered theory.
Step 2: Identify phenomena that, if true, the under-considered theory would explain better (according to theory-neutral standards of explanation) than widely accepted theories.
Step 3: Of the phenomena in Step 2, identify those that are deemed relevant by proponents of the widely accepted theories.
Step 4: Any phenomena in Step 3 that face data constraints are stylized facts.

Call this the *Broadening Strategy*. This is an idealized reconstruction of Kaldor's reasoning, but has the benefit of providing relatively clear methodological advice. Note that both of our methodological benefits are realized upon successful execution of Step 3 of this strategy: inquirers have more (purported) phenomena to explain and they have reason to consider the previously neglected theory because it explains things that the accepted theory does not.

4.4. *Complementary triples*

Earlier, we suggested that stylized facts exhibit an inner logic when complementary triples are possible. In these triples, some elements of a stylized fact justify its other elements. For instance, the data constraints make certain methodological benefits pressing. Stylized facts play a role as a means of realizing these methodological benefits. Consequently, it becomes good methodological advice to posit stylized facts under such constraints.

Kaldor's case fits this template nicely. When reliable data are unavailable and there is a heavy focus on a particular theoretical approach, the methodological risk is that the preferred theory is a just-so story, i.e. its fit with the evidence is merely fortuitous or ad hoc. To avoid the charge of ad hocness, it is thus methodologically beneficial to create

additional, plausible constraints on admissible theories, and to consider other theories. If a theory outperforms these new competitors under these additional constraints, then charges of ad hocness are muted. As we have seen, stylized facts play a role in securing these benefits via the Broadening Strategy.

In short, in Kaldor's case, data constraints dictated that certain anti-ad-hoc measures would be beneficial. But once these benefits are in place, the Broadening Strategy becomes rational to pursue. Hence we have a justification that proceeds from data constraints to methodological benefits to methodological roles. In this way, we have one coherent, principled account of when it is reasonable to stylize our facts. We stress that this may be only one of many such accounts.

4.5. Appending

Recall that many stylized facts are transient. In other words, when everything is working smoothly, they eventually get dressed down and become BFs. Specifically, data constraints are eventually overcome through a process we have called appending, i.e. stylized facts are made inferable from reliable data.

Economists are certainly appending the Kaldor facts. Note that appending is not simply empirical confirmation of a stylized fact. Rather, it is a two-way street: data are gathered with the hopes of inferring the stylized fact, and stylized facts get revised in light of new data that delimits the conditions under which they hold. Thus, recall that for all but KF6, Kaldor facts were discovered to be restricted to advanced economies. Economists have delimited the scope of Kaldor facts accordingly. For instance, KF1 simply stated that the per capita growth rate was positive. More recent empirical evidence provides interesting counterexamples to this stylized fact. For instance, Angola's GDP per capita was around $1100 US 1990 Geary-Khamis dollars and dropped to $744 by the end of the twentieth century.[12] More infamous is the roller-coaster growth experience of Argentina. While it was one of the top ten richest economies at the turn of the twentieth century, now it sits comfortably as a middle-income country after experiencing numerous crises with deeply negative growth rates. These and other examples gave way to empirical developments that fall under the purview of KF6, with the caveat that some countries' growth rates could be negative – KF1 notwithstanding. In this way, KF6 has become the basis of economic growth research in the last years.

Indeed, even greater refinements of this stylized fact are possible in virtue of the extensive datasets on national accounts now readily available (see for example the Maddison Project and the Penn World Tables).[13] For instance, per capita income growth rate is sometimes negative for developed countries. Figure 2(a) presents GDP per capita for the USA in the last 130 years. This qualifies as a long-run view of the US economy, the type of framework that economists favor when discussing economic growth. Over this long period of time, the GDP per capita growth was not positive every single year. For example, take the period between 1929 and the mid-1930s, also known as the Great Depression. Tracing the evolution of GDP per capita clearly shows a negative path that is later followed by rapid growth in the following decade. Importantly, the overall trend during this period of time, represented by the dashed line, exhibits a positive growth rate. The same distinction is seen in panel (b), where we calculate annual changes in GDP per capita for actual GDP per capita (bold line) and its trend (dash line). From a year-to-year perspective, annual GDP per capita growth takes values ranging from over − 20% to 20%; however, when computing growth rates for the GDP per capita, the trend is positive, averaging around 2% during this period.

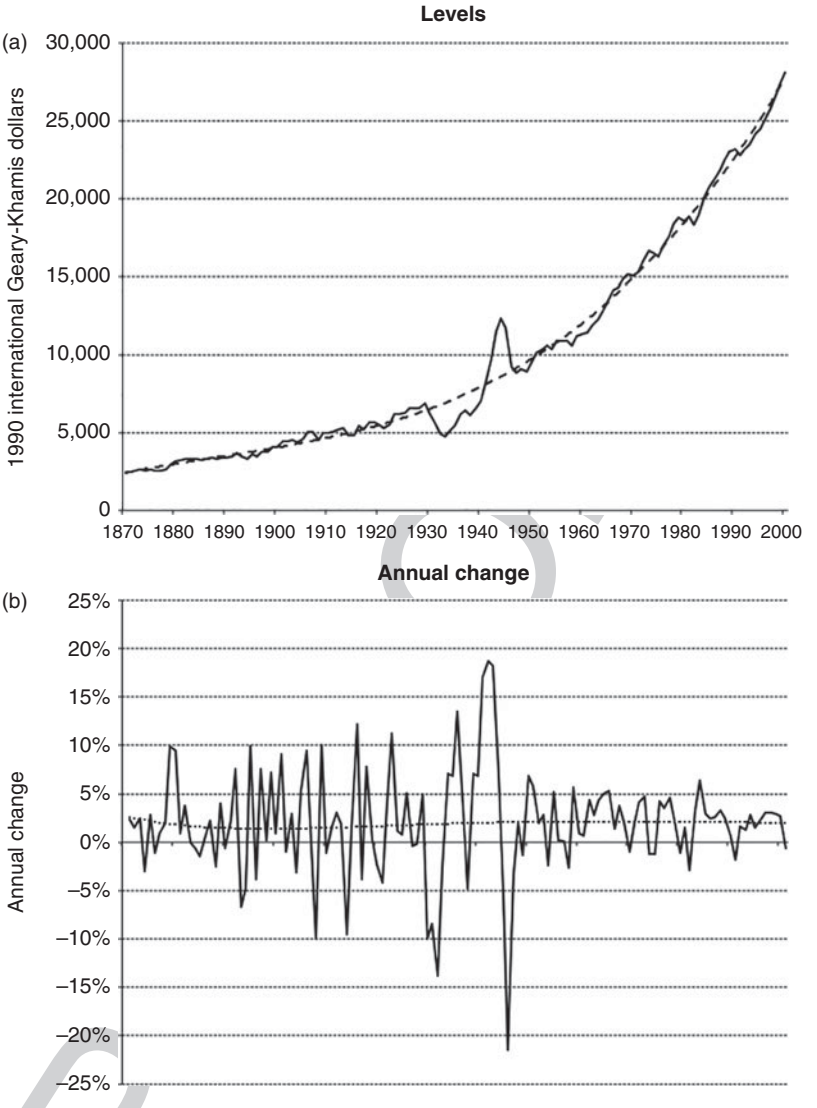

Figure 2. US GDP per capita, 1870–2000: (a) levels and (b) annual change. *Source*: based on Maddison (2002).

Thus, in this case, a short-run anomaly, the Great Depression, is a distinct phenomenon from the long-run trend described. Both are deserving of explanation, and both are well supported by reliable data. While the short-term growth rates are far from stable, this is not the phenomenon of interest for the field of economic growth. Instead, growth economists are interested in explaining the long-term, positive trend. By contrast, economists interested in business cycles will explain short-term changes in GDP, which can be either positive or negative. Hence KF1 becomes a BF, but so do its exceptions.

Importantly, appending does not always yield the expected results. As we have already seen, most of the Kaldor facts were restricted to developed countries – a point that Kaldor failed to consider. But subsequent research has also revealed that KF3 is not even the rule

among developed countries. According to Barro and Sala-i-Martin (2004), KF3 applies only to the UK; for most other economies, the empirical evidence points to declining rates of return to capital over time as an economy develops. When stylized facts aim for generality but fall so remarkably short, it is fair to say that they are largely discredited. Of course, this is not to say that all stylized facts are subject to this fate.

Thus, the process of appending has allowed growth economists to accommodate all of those 'snags and qualifications' that were bona fide impediments to theorizing during Kaldor's time, but that have since been overcome to a significant degree. The result is that several of Kaldor's facts have become BFs and one a discredited stylized fact.

4.6. Shedding

Recall that stylized facts may also be dressed down through a process we called shedding. Shedding occurs when the stylized fact no longer plays its methodologically beneficial role. As we have seen, Kaldor's stylized facts expanded the phenomena to be explained and the theoretical options by way of the Broadening Strategy. The Kaldor facts' roles in procuring these benefits are being shed.

First, as we have just seen, the Kaldor facts are being appended. Consequently, stylized facts need not provide the first of these benefits – expanding the phenomena to be explained – as BFs are replacing them in this capacity. Second, the explanatory advantages that a previously under-considered theory has over more widely accepted theories become important desiderata in subsequent research. In this way, economists can enjoy the methodological benefits of an under-considered theory without accepting the theory *tout court*. In this case, Kaldor's insights about endogenous growth have been assimilated by contemporary theories of growth. For example, Kaldor (1957, 1961) considered the possibility of endogenous growth in a similar fashion as the model developed by Lucas decades later. Jones and Romer (2009, pp. 3–4) claim that Kaldor's theoretical framework anticipated many contemporary insights:

> Writing in 1961, Kaldor was already intent on making technological progress an endogenous part of a more complete model of growth. The tip-off about his intention is the inclusion of his final fact, which cited the variation in growth rates across countries [. . .].

Modern growth theorists have refined this theoretical extension and expanded the endogenous variables to include institutions, human capital, and ideas.

5. Conclusion

To summarize, we have provided a philosophically informed analysis of stylized facts. Its core ideas are that stylized facts require less than their counterparts in that they arise in the face of data constraints, but also require more in that they provide distinctive methodological benefits. We then showed how that framework provides a compelling interpretation of Kaldor's canonical use of stylized facts.

As mentioned at the outset, our goal was to provide a methodologically useful analysis of stylized facts. In short, our framework indicates when it will be useful to stylize facts, and when using that label is less illuminating. The short answer is that stylizing facts makes sense when one's data are constrained *and* stylizing the fact plays a methodologically beneficial role. However, we have also seen that complementary triples suggest that many of the most principled uses of stylized facts arise when they are methodologically beneficial *because* one's data are constrained. So a fruitful extension of our account would identify different methodological benefits that arise under different

kinds of data constraints, and then discuss how stylized facts might resolve some of these difficulties. At a minimum, those economists who use stylized facts should begin to justify their use of these facts with these ideas in mind.

Furthermore, we have seen that stylized facts are often transient. Consequently, even at their inception, we counsel economists to anticipate ways of overcoming data constraints through appending (where possible) and ways of shedding gratuitous methodological benefits.

Finally, we end by suggesting that many social-scientific facts are stylized. In particular, the social-scientific penchant to draw broad conclusions in the face of data constraints – e.g. about human psychology and decision making from studying college underclassmen in western countries; about a culture or a nation from interviews in a few scattered villages; about an historical epoch from a smattering of archival sources; or about social and political institutions from a few cases studies – is not unlike Kaldor's situation in 1961. If social scientists are to maintain lofty explanatory ambitions in the face of these constraints, then we hope that our account of stylized facts will prove useful to them.

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Notes

1. Email: larroyoabad@middlebury.edu
2. Hence, this should not be read as a contribution to the history of economic thought.
3. The use of this production function is standard in the economic growth literature. For example, Barro and Sala-i-Martin (2004, p. 29) in their graduate level textbook on economic growth claim that this function 'is often thought to provide a reasonable description of actual economies.'
4. Economic growth as a topic has been present in earlier economic literature going back to Adam Smith's *Wealth of Nations* (1776); however, the development of complex mathematical models dates back to mid-twentieth century with the introduction of the models by Harrod (1939), Domar (1946), Solow (1956), and Swan (1956).
5. This idea and the following discussion about data and phenomena draws heavily upon Bogen and Woodward (1988). Also, we shall see that there is an implicit temporal index in our analyses of both bare and stylized facts. In other words, more precise analyses would assume the following form: *p* describes a bare/stylized fact at time *t* if and only if … at *t* …. We omit this temporal index for ease of reading.
6. Glymour (2000) suggests that the data-phenomena distinction be replaced by the sample-population distinction in all scientific contexts. By contrast, Woodward (1998) develops broader accounts of validity and reliability that could, in principle, extend beyond the narrower statistical definitions we use here. We do not intervene on this larger discussion, and only hold that the data-phenomenon distinction is *usually* as Glymour describes it *within the discipline of economics*.
7. An anonymous referee has suggested that facts may admit of 'degrees of stylization,' while our account makes stylization categorical. We are congenial to this idea, but bracket it for current purposes. Very roughly, we take a fact to be more stylized when it faces greater known and explicit data constraints.

8. We thank an anonymous referee for suggesting that we decouple useful stylized facts from the broader genus of stylized facts.
9. Lawson (1989) provides a detailed analysis and defense of the later Kaldor's account of stylized facts.
10. For Central America, the UN issued the national accounts statistics in 1957 for 1950 through 1955 while estimates for Latin America were published in 1964 for the period 1948–1960 (CEPAL, 1957, 1964). The first set of long-term estimates appeared in 1978 covering the 1920s through the early 1970s (CEPAL, 1978).
11. Both Stanford and van Fraassen draw strong skeptical conclusions about ever overcoming the 'bad lot problem.' However, they both countenance more pragmatic or practical responses to this problem, which suffices for our purposes.
12. GDP data for African countries are only available from 1950s onwards. See Maddison (2002).
13. See Bolt and van Zanden (2014) and Heston, Summers, and Aten (2012), respectively.

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