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Article

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Finance and Society

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Suggested Citation: Husbands, Conor (2020) : Esposito's temporality of finance: Endogeneity and revisability in derivative transactions, Finance and Society, ISSN 2059-5999, University of Edinburgh, Edinburgh, Vol. 6, Iss. 2, pp. 114-129,
<https://doi.org/10.2218/finsoc.v6i2.5270>

This Version is available at:

<https://hdl.handle.net/10419/309385>

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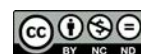
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Esposito's temporality of finance: Endogeneity and revisability in derivative transactions

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Abstract

Recent years have seen greater interest in the theoretical foundations of abstract finance and their intersection with questions of philosophy and sociology. In particular, exchanges between authors such as Donald MacKenzie, Timothy Johnson, Elie Ayache, and others have debated the deterministic or contingent dynamics of markets, as well as their interdependency with the theories that purport to describe them. Working in this tradition, Elena Esposito raises a novel question in her 2011 book, *The Future of Futures*: could the exchange of derivative securities within financial markets entail not so much the provision of liquidity, but the transaction of time? In this article, I reconstruct Esposito's analysis, arguing that the proper response to this question should be affirmative. Particular emphasis is laid on what I take to be the two fundamental and controversial premises which support this argument: first, the endogeneity of time-relations involved in financial markets; and second, the revisability of these time-relations. The advantage of recasting Esposito's position in this way is the defence it enables against various criticisms articulated in theory and philosophy circles, such as those of Ray Brassier. Finally, I discuss the significance of Esposito's theory, not only for this class of financial transactions, but also for certain issues in the philosophy of time.

Keywords

Finance, temporality, derivatives, philosophy of markets, Elena Esposito, Ray Brassier

Introduction

The last decade or so has seen an upsurge in literature on the theoretical foundations of abstract finance and their intersection with questions of philosophy and sociology. Whether driven by vestiges of the 2008 crisis or continued theoretical interrogation of financial models, debates regarding the dynamics of financial markets and their interdependency with financial

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<https://doi.org/10.2218/finsoc.v6i2.5270>

economics continue to engage diverse registers. Donald MacKenzie (2006: 12) asserts the entanglement of academic economics with the life of markets, describing theory as “an active force transforming its environment, not a camera passively recording it”. Elie Ayache, in *The Black Swan* (2010), *The Medium of Contingency* (2015), and other texts, makes ostensibly deterministic pricing models contingent, addressing “the recalibration of the derivative pricing model as a radically contingent event” (Ayache, 2016: 205). Building on Ayache’s work, Suhail Malik (2014) analyses this contingency in three forms: the fungibility of what is priced, the variability of price, and the volatility of pricing. Most recently, Timothy Johnson (2016: 202) alludes more broadly to “substantial links” between technical finance and the work of modern philosophers such as Alain Badiou and Quentin Meillassoux, asserting commonalities between distant fields, and providing ample evidence of increased and increasing willingness on the part of scholars to evaluate such links.

Relative to these contributions, it might be thought that Elena Esposito’s research in this domain only recapitulates familiar themes already developed more fully by other authors. Following prior research in the social studies of finance (Knorr Cetina and Bruegger, 2002; MacKenzie, 2006), Esposito (2011: 11) considers prevailing theories to lack “circularity” and neglect the bilateral dependency of economic theory and social behaviour. No longer objective, descriptive empirical sciences, for Esposito, economic and financial theory informs expectations about the decisions it purports to describe, and agents reflect these expectations in their own comportment. But, in spite of these commonalities, there remains a proto-philosophical kernel of Esposito’s which is an original and additional intervention into the literature on the theoretical foundations of finance. In it, these notions are not only taken over and extended, but also revealed as manifestations of a more fundamental theme: the temporality of the systems in question. Esposito (2011: 9) asks, “Is it possible that the problems of economics that we are faced with at present ... have to do with the ways with which time is dealt?” From this perspective, the financial crisis becomes “a matter of oversimplified visions of the future and of risk that referred to the present” (6). Money, interest, risk, and consumption – not only these but also a vast span of other economic and social categories carry camouflaged metaphysical content and, once their occluded temporal dynamic is properly excavated, require revision. Whilst her peers are in no way oblivious to the importance of temporal assumptions in the foundations of finance – indeed, Jon Roffe dedicates an entire chapter to them in Part 2 of his *Abstract Market Theory* (2015) – Esposito’s work features a particularly sustained engagement with them. This is a distinctive mark of her approach.

Esposito’s account is multifaceted and imbues behavioural finance, monetary theory, political economy, and other sub-disciplines with philosophical and specifically temporal import. For one, like Ayache, Roffe, and MacKenzie, she adduces the increasing prominence of the Black-Scholes-Merton option pricing model in the 1980s and 1990s as evidence of the specular dynamics of pricing – in spite, it must be said, of some reticence as to the extent of its actual implementation.¹ In the context of theories of price movement, contrary to the hypothesis that causal influences propagate asymmetrically – which is to say that past conditions, such as the variables of which prices are functions, affect the future without being affected in return – Esposito (2011: 22) contends that, “Constraints are not unidirectional, always proceeding from the past to the future, but can instead be understood as multidirectional, proceeding from the future to the past”. Such a perspective figures in her extended development of the notion of revisability (the revisability afforded by the acquisition of derivatives) and in the eponymous thesis which plays a pivotal role in her argument. Further, Esposito shows how growth subjects more and more phenomena to the dynamics of exchange

and valuation, how financialisation replaces utility and custom by market value, and how more and more complicated dynamics come to influence their price. As a result, expectations about price movements count less than expectations about such expectations – a recursive spiral which increases sensitivity to unpredictable swings in market sentiment, introduces additional volatility, and intensifies the prospect of financial contagion.² Esposito thus attributes the concrete implications of the financial crisis to metaphysical aberrations. The philosophical implications of derivative instruments are thus as diverse as the heterodox claims which show up in *The Future of Futures* are provocative.

The academic response to Esposito's work is less than commensurate with the stature of these claims, which defy the tendency for philosophers of time to operate at a distant remove from the preoccupations of the everyday. *The Future of Futures* bears directly upon present economic and political quandaries, reaching their apex in the aftermath of the crisis. Despite this, a limited amount of relevant commentary has arisen. Esposito's claims are addressed in Malik's 2014 extended essay on 'The Ontology of Finance', which draws heavily upon her discussion of 'time-binding' (see Esposito, 2011: 18-37).³ Malik uses this to ground his own account of finance's generation (or 'inscription') of ontological contingency. Esposito's ideas also inform the early work of Jens Beckert (2014) in this area and feature prominently in Ray Brassier's 2017 seminar paper, 'Pricing Time'. In none of these, though, is the specifically philosophical import of Esposito's innovation examined for itself.

In view of this hitherto modest response, this article aims to formulate clearly the most important metaphysical tenets of Esposito's position, and to subject them to critical review in the context of the philosophy of time. In the course of this analysis, Esposito's argument (spread over hundreds of pages in the original and embedded in extended quasi-historical discussions of the role of money, the financial crisis, and the nature of instruments such as derivative securities) is formally reconstructed. Two propositions are identified as contributing much of the metaphysical content of Esposito's approach: first, her Endogeneity Thesis, which asserts that temporal relations and determinations are system-specific (a thesis consonant with broader trends in modern philosophical discussions of temporality); and second, her assertion of the variability of these relations and determinations. For Esposito, the dynamics of a given system (e.g., a particular financial market) are determinative for these relations. They constitute a local time whose relations are independent of global time-relations. Moreover, these relations vary; in particular, they are revisable from moment to moment. The advantage of this formulation of Esposito's argument, and of drawing attention to these two theses, is not only a gain in clarity and the increased potential this affords for critical engagement on the part of philosophers; it also enables a defence of Esposito's theory to be mounted in response to objections raised by Brassier in his recent discussion of Malik's ontology of finance.

The article proceeds by first presenting and reviewing Esposito's argument. After this it develops an analysis of the Endogeneity and Revisability Theses. It then considers and motivates Brassier's objection to this argument, and in particular his assertion that the rigorously deterministic relations, which govern the markets whose dynamics fall within the purview of Esposito's analysis, are inconsistent with the Revisability Thesis. A defence of Esposito's account is then proposed against Brassier's reservations. This defence casts into clearer relief the advantages of this article's reconstruction of her line of thought.

Endogeneity and revisability in derivative transactions

Being diffuse and expressed in a mixture of theoretical registers, it is helpful to extract the

most important metaphysical propositions from Esposito's analysis. These present time as a tradable object, as enumerated below.

- 1) Time-relations are internal to systems
- 2) Financial systems are comprised of expectations about prices
- 3) Present future and future present bound the future
- 4) The present future amounts to expectations (about prices)
- 5) The future is the revisability of the present future and the future present
- 6) Derivatives enable the revisability of expectations (about prices)
- 7) Derivatives sell the future
- 8) Derivatives transact time

Premise 1 is Esposito's Endogeneity Thesis. It surfaces in a number of guises in the second chapter on 'Time Binding', a term coined by Alfred Korzybski then adapted and developed by the sociologist Niklas Luhmann who, like Esposito, considers social and economic systems as embedding notions of time in their behaviour, whether or not accompanied by an explicit "conceptualization" of time (Luhmann, 1991: 34). First of all, the Endogeneity Thesis appears as what Esposito (2011: 23) labels a principle of "temporal relativity". This thesis can be defined in opposition to a principle of temporal absolutism, namely that time is independent of events or "autonomous"; more fully, "the impression that there is an autonomous time dimension, a time that serves as a stable reference and influences both concepts and attitudes" (Esposito, 2011: 23), rather than concepts and attitudes and any and all contents of this dimension influencing or constituting time. For Esposito, there is no absolute or universal time which might preside over the times of different systems. Some historical context assists in interpreting this position. As an illustration, it can be contrasted with the position of metaphysicians working in the Newtonian tradition such as Samuel Clarke (Alexander, 1956: 105-7), or with the way in which imperial chronometry sought to resolve the flow of time as kept in various regions of empires into a standardised superordinate time:

Even a master clockmaker's finest work would offer only pale reflections of the higher, absolute time that belonged not to our human world, but to the 'sensorium of God'. Tides, planets, moons – everything in the Universe that moved or changed – did so, Newton believed, against the universal background of a single, constantly flowing river of time. (Galison, 2003: 19-20)

Instead, for the tradition Esposito stewards, different systems and the different theories describing them possess different times, which need not be coordinated or subject to common measures:

Time is, therefore, seen as a structure of systems, a structure that gives an order to operations and connects them to one another. (Esposito, 2011: 22)

Insofar as time is a structure of systems as Esposito declares, time-relations – relations of events, such as are involved in preceding or following – are internal to those systems. The time comprised by the Earth's rotation about its axis, the series of alternations between day and night, pertain to the dynamics of the solar system and its orbit of the sun, and to the customs and habits civilisation establishes around them. The time comprised by genetic mechanisms which encode the lifecycle of the human organism regulate its growth, decay, and eventual disintegration. The half-life of a caesium-137 nucleus, the gestation period of a tiger, the

transitions between different stages of psychological development, pertain to the incongruous forces which animate each of them for their own part. Esposito denies that the temporal properties of these systems and processes – the position of the constitutive events in time, or the relations of these events to each-other, being-before or being-after – are reducible to a common set of temporal properties. It is in this sense that her writings repudiate absolute time as superfluous. These remarks express Esposito's thesis of endogeneity. As this article will show, this position unlocks the broader philosophical insight to be gleaned from her analysis of financial markets; it allows the labyrinthine trade in financial instruments and abstract derivatives to constitute their own system of time.

Premise 2 is definitional and qualifies the scope of Esposito's analysis. The system whose time dynamics are in question is the financial system and, of particular interest, the voluminous market for derivative instruments (CDOs, interest rate swaps, VIX futures, etc.). What is most meaningful (and controversial) about this premise is the subject matter upon which her discussion fixes. The characterisation of this system in terms of expectations is *prima facie* arcane, clashing with more familiar motivations couched in such terms as the infusion of liquidity, provision of credit, transfer or hedging of risk, *inter alia*. Why reify expectations? Esposito's rationale is that the transactions which comprise this system contemplate less the characteristics of the underlying subject matter (whether a resource such as a bulk commodity, an interest rate, or performance of a loan) from which a derivative derives, or the referent of the instrument traded, than it does traders' expectations about price movements. The forces driving these transactions are not objective characteristics of the goods, the subjective utility of the underlying to a consumer, the discounted value of future cash flows derivable from them, or their production cost adjusted for a required return. Rather, and contrary to traditional doctrines about price levels such as efficient market hypotheses (in which they reflect complete informational availability), Esposito holds these to be functional on expectations – in a dual sense, not only the sense in which participants' views on pricing adequacy are informed by their stance on what the consensus price will be at a future time, but also the second-order sense in which, given that price levels prevailing at any given time reflect expectations and that prices are set within a market, taking positions presupposes forecasting future prices and thus future expectations, producing a highly circular trading environment. She posits accordingly:

Although markets have always had their dynamics, which are led by the mutual observation of observers, this observation has now become the real object of transactions. (Esposito, 2011: 95)

To the extent that a set of pricing dynamics produce the salient features of the financial system, these remarks lend support to Premise 2, which is extended later in Esposito's argument.

With her next two premises, Esposito most explicitly veers into the terrain of temporality. Premise 3 posits a familiar distinction between the future present and the present future:

The uncertainty of the future is expressed by the fact that the future price of an asset does not coincide with the expected value of the future spot price. In other words, the future price in three months is not the same as the expected price of the asset three months later ... The estimate of risk marks the difference between these two prices. (Esposito, 2011: 136)

Here, Esposito's distinction appears as a distinction between expectations and reality: the present future is the future we expect, the future present the future that will be. Similarly, elsewhere she refers to the present future as "our current anticipation of the future" and the

future present as among “the presents that will become actual in the future” (Esposito, 2011: 23-24). Importantly, though, Esposito’s formulation of this distinction centres on uncertainty, whether reflective of epistemic limitations or ontological indeterminacy. In bounding the future by present future and future present, as per Premise 3, Esposito defines the future as an oscillation and interchange between these two modes of time: the future is the iterative formation and revision of expectations. Brassier, in his commentary on Esposito’s work (through the prism of Malik’s 2014 essay), offers his own succinct definition:

The distinction between the present future ... is ‘our current anticipation of the future’ and the future present ... the ‘present that will become actual in the future’. (Brassier, 2017: 95)

The present future, as expected, is inactual; the future present becomes actual. Further, Premise 4 is a definition which follows readily from the foregoing, subject to the clarification that the subject matter of Esposito’s analysis is, once again, financial markets together with what she takes as the most important variable which encodes their dynamics, namely price levels. As will be explored more fully when Brassier’s own critique is developed, one immediate consequence of this proposition is its suggestion of idealism, insofar as Esposito’s position contemplates expectations about prices, rather than prices themselves. Expectations are subjective or, at best, intersubjective, yet price movements are (it would be thought) objective. A possible loss of generality is implied by this framework, then, in spite of its increased precision. Sections two and three address this concern in more detail.

Premise 5 provides a definition of Esposito’s esoteric usage of the term ‘future’, which modulates frequently, as can be observed in the distinction between present future and future present. For Esposito, this term refers to neither of these two – nor indeed to the distinction between what is actual or inactual, which she takes over from the work of Luhmann – but rather to revisability, and to the difference between present future and future present. How can we make sense of this definition, and what is gained by couching futurity in terms of revisability? The following passage provides further elaboration:

The temporal integration of the system (the fact that the different presents all belong to the same time) is not given once and for all on the basis of the fact that the past precedes the future, but is instead continuously produced and revised as time progresses (the constraints introduced in the present are subsequently revised in the context of a control that evaluates and corrects them, but remembers their past sense). The future redescribes the past in accordance with how it remembers the way in which the past present had projected its future, and recognizes itself as the future of that past, as a different perspective inside the same time (selections have an order, and that, as we have already stated, is what time is needed for). (Esposito, 2011: 27-28)

These remarks not only help develop the notion of revisability, but also contain much of Esposito’s metaphysics of time. A number of distinct theses can be derived from them.

First of all, from the fact that the past precedes the future it does not follow that the past determines the future. The denial of this logical relation opens a distinction between the temporal order of events and the order in which they are determined, or in which the “temporal integration” of which Esposito speaks is established. Not only the outcome predicted by past expectations, but revisions made to past expectations about the value of a security, govern the evolution of its price in time. As much as the bubble of credit which proliferated in the subprime mortgage market preceded the 2008 financial crisis, this bubble was only determined as such, determined as a bubble, after the emergence of widespread defaults. Whatever conditions may have prevailed in the past of 2008, the months and years prior to the

crisis, the overvaluations and price corrections, then inconceivable for all but a select few adepts, it was only with the cascading revisions to collective expectations, then a singular future event, that this outcome was determined.

Secondly, this temporal integration of the system, consisting of the relations which bind moments together, and in this sense “the fact that the different presents all belong to the same time”, such as sets of events connected by natural laws or economic theories which describe them, is itself variable. Being at a given position in time, or occurring before or after another event, is a mutable predicate. Indeed, it is in this sense that time itself is subject to time, such as would be the implication of the claim that temporal integration occurs as time progresses.

Lastly, with the contention that “the future redescribes the past”, not only the structure of time, such as the order of events and the order of their determination, but also the very contents of time are revisable: the future “recognises itself as the future of a past” and generates the past which is consistent with it, just as, following Esposito’s example, fashions appear and disappear discontinuously, bringing with them immanent criteria which cast previous fashions in different lights. As revisions are made to the interpretation of market events required for the formation of expectations, new phenomena are revealed not present before, and previous observations recede into insignificance.

These are, therefore, the three senses in which Esposito characterises the future as revisability: first, the fissure of the order of events and order in which they are determined; second, the variability of time-relations themselves, whether cardinal or ordinal; and third, the contents of time, events with their qualitative peculiarities and haecceities, varying in time. This ostensible abstraction in fact provides a crucial link to Esposito’s central metaphysical thesis, concerning the temporal effects wrought by the transaction of derivatives. As will be shown in the following analysis of her remaining premises, it is owing to the power of derivatives to allow expectations (the reciprocal expectations of observers) to be revised, that such effects can be exerted. Derivatives pertain to time because they pertain to time *qua* revisability.

Nonetheless, there is a lingering opacity to these propositions, which stand out as the metaphysical apotheosis of *The Future of Futures*, invoking temporal predicates, determinations of cardinality and ordinality with respect to time, and other unintuitive notions. Much of this can be dispelled with Esposito’s quite concrete and quite simple examples and illustrations – which serve not only as examples and illustrations, but also as logical grounds of Premise 6. Derivative securities, in Esposito’s framework, pertain to expectations. How might this claim be explained and developed?

Firstly, this framework breaks with traditional accounts of these securities’ purposes, such as the provision of liquidity or the hedging or transfer of risk. As Malik (2014: 629-36) observes, in contradistinction to the somewhat outmoded staging which surfaces and resurfaces in academic economics (such as impecunious farmers purchasing forwards to protect themselves from wheat price fluctuations, or SMEs exposed to exchange rate volatility entering into currency swaps as an offset), the volumes of derivatives traded, measured either by notional or marked-to-market values, dwarf the volumes explicable by non-speculative motivations (Hull, 2002: 71). These theories thus hardly suffice to explain the market dynamics associated with these securities. However, a more important contrast to draw for present purposes follows from the fact that the temporal and therefore metaphysical implications of these dynamics remain obscured by such explanations, suggesting the need for more thorough excavation. Esposito (2011: 110) observes in this vein that “most derivative contracts close without the exchange of anything more than the mutual observation of

observers and their expectations” – not as if to deny that such contracts are ultimately financially settled, but instead to assert the following: rather than the underlying commodity which would be the putative object of such trades being exchanged at the settlement of a contract, it suffices for the difference between the spot price of the underlying and the strike price of the option, or forward price of the forward (*mutatis mutandis* for other instruments), to be remitted in order for any and all obligations assumed in them to be discharged. This difference is a difference between prices, and thus a difference between prices which themselves reflect anticipations about price movements, rather than demand, or intersubjective utility. Derivatives transactions are thus settled based on expectations about future expectations: “Although markets have always had their dynamics, which are led by the mutual observation of observers, this observation has now become the real object of transactions” (Esposito, 2011: 95). Far from being an aberration, speculation is seen to be intrinsic to markets.

These considerations connect readily to the notion of revisability, which features in Premise 6 and can be used to furnish a more formal justification of this premise. Consider a derivative D which derives from an underlying U . The expectations of a market participant (as a potential acquirer of D) may peg the underlying’s spot price at given time t at a level P . In Esposito’s terms, P amounts to the present future price of D . Now, all of the multifarious ramifications of this participant’s expectations reflect P – the willingness to trade U in the present, the ability to take actions which might depend on the availability of U as an asset or a resource, or the implications of P for other variables. With the arrival of the future present, though, P may not obtain, but some other price P_F . What is the specific relation of derivatives trading to this complex? “What is traded on derivatives exchanges is not the future given (the then unknown strike price of the underlying) but the present *risk* of that price against the delivery price” (Malik, 2014: 713). Derivatives trading allows the increase or decrease in, the magnification or nullification of, or the losing or profiting from this difference between P and P_F (‘risk’ or ‘uncertainty’ in the terms of Esposito and Malik). Their subject matter is therefore precisely this difference, the risk and uncertainty posed by it, and their function is precisely its management or exploitation. For instance, combinations of options which form a straddle⁴ at a given price level promise to compensate the purchaser for any price fluctuation of sufficient magnitude, positive or negative, in exchange for a premium (inversely related to the magnitude required), potentially enabling them to comport themselves as if indifferent to such price movements, or to profit or lose from them. In sum, derivatives concern expectations; these expectations in turn concern the expectations of others, forming a collective whose interdependencies constitute the market and determine price levels. As Esposito neatly summarises:

Derivative instruments are used to manage the difference between the present future and the future presents in the present, between what one can expect to happen tomorrow, today, and what will actually be achieved tomorrow, as a result of what one does today in order to prepare for it. Derivatives allow one to make decisions today that affect the way the future will be, while preserving the freedom to decide one way or the other when this future will be present. (Esposito, 2011: 105)

The revisability of participants’ expectations, constituted by the difference between the present future and future present, is in this sense what is enabled by the acquisition of derivatives couched in this difference. This is the rationale for Esposito’s Premise 6.

By way of further illustration, Esposito offers as a case example the Black-Scholes-Merton pricing model. Researchers in the field of financial engineering, aiming to develop quantitative tools for the pricing of options, had been beset by the conundrum as to how the future prices

of the underlying of an option on could be correctly predicted, then taken to be a prerequisite for an adequate theory. The stratagem of Black, Scholes, and Merton involved jettisoning this presupposition, a presupposition which equated to the stipulation that, “One should know the future present” (Esposito, 2011: 105). As Esposito remarks, “On this level, there is obviously no possible objectivity. The Black–Scholes–Merton solution avoids the problem by changing the time perspective and moving to that of the present future” (137). With this approach, which no longer contemplated the future present price but rather the assumptive present future price, it sufficed to understand “what operators presently know about the future” (114), whether right or wrong. This change in view, resting crucially on the distinction between P and P_F , manifests itself in the appearance of volatility in the model, a quantity defined as the standard deviation of returns on the underlying asset and appearing in the distribution functions which assign probabilities to different future prices. Rather than the single future present price, plural discounted (present) future values, weighted by a probability measure, become the subject matter of the stochastic model. It is not so much that the model contains an *a priori* or empirical distribution which specifies the future spot price independent of observers’ changing expectations. These weighted values feature in the no-arbitrage condition motivating the classic formulation of the model, which equates values of call and put options with purchases and sales of the underlying asset together with commensurate debt instruments. The prices of options thus reflect pricing expectations concerning the present future, not the already determinate future present price. Indeed, over time, as the prices of these options change in response to market events, whether changes in volatility, interest rates, underlying prices, debt markets, and so on, and whether owing to behavioural factors or supply and demand, these expectations change. Then, with the equivalence embedded in the Black-Scholes-Merton model between these factors and options (as well as the hedging possibilities they imply for participants), owning derivatives enables changes to prices to come about, and thus the collective revision of expectations as to their behaviour.

Premises 7 and 8 are consequences of the foregoing propositions, and the culmination of this elucidation of the initially unintuitive connections Esposito draws between derivatives and temporality, claiming as she does that they “set the conditions for the future in the present” (4), “sell time in the form of the management of uncertainty” (105), “decide about time using time” (105), and so on. The future is the movement between future present and present future; this amounts to the iterative revision of expectations, particularly expectations about pricing levels and probable movements. But if the transaction of derivatives enables this movement also, then the transaction of derivatives involves the transaction of this future. Purchasing derivatives enables agents to form and revise bundles of expectations about price movements and, most importantly, to reflect these expectations in their behaviour, from their choices about what resources to acquire, to their subjective valuations of other assets and instruments and their levels of risk-aversion. This is the sense in which Premise 7 is a logical consequence of Premises 4, 5, and 6. The concluding Premise 8 then summarises the sense in which the subject matter of Esposito’s analysis is time itself, namely, the sense in which modes of time are objects of the trade in derivatives: “The future is produced – that is, time is traded” (Esposito, 2011: 72).

Pricing time: Brassier’s critique

Having reconstructed Esposito’s argument that time is an elliptical object of financial transactions – an argument as innovative as it is contentious – it is natural to consider the critical response to it. From the limited available commentary, Ray Brassier’s discussion in

'Pricing Time' is perhaps the most incisive, posing the most serious challenges. His focus is in fact only secondarily the work of Esposito, first and foremost addressing Suhail Malik's 'The Ontology of Finance', an extended essay from the 2014 edition of *Collapse*, which synthesises Esposito's work on the temporality of finance with the thought of Jacques Derrida and others (in particular Nitzan and Bichler, 2009). Nonetheless, Brassier's commentary has no less decisive importance for an analysis of *The Future of Futures* and the other texts which contain Esposito's economic reflections on temporality. Brassier's analysis displays traits befitting of the continental or 'speculative' realism project which has been the backdrop for much of his research, as well as that of his contemporaries such as Quentin Meillassoux. In opposition to what it takes to be the idealistic tendencies of post-Kantian metaphysics, insisting as it does on the correlation between thought and being itself ('correlationism'), and therefore the givenness of being, this form of realism aims precisely to grasp the world not only as it is given, but absolutely, as it is in-itself (see, for instance, Meillassoux, 2008: 20; Ennis, 2011: 24-30).⁵ It thus counterposes its own form of realism to the idealism to which it takes contemporary metaphysics to be tied, so long as it subscribes to the correlationist hypothesis. In terms of his challenge to Esposito, Brassier alleges an unavowed commitment to idealistic subjectivism in her Revisability Thesis. Brassier counterposes to this thesis the claim that there is an objective, empirical determining factor operative in pricing, regardless of its performative elements (Brassier, 2017).

These remarks amount to a confrontation with Premises 5 and 6, and their temporal commitment to revisability. Premise 5 defines the future in terms of the revisability it attaches to time-relations; Premise 6 attributes this dynamic to the trade of derivatives. To the contrary, Brassier's assertion that there is a determining factor operative in pricing targets revisability. Equivalently, it undermines the distinction between present future and future present as forwarded by Esposito. For Brassier, any distinction between these is equivalent to a statement about epistemic limitations, and therefore a more mundane distinction: between agents' expectations on the one hand, these being based on inexorably incomplete information, and, on the other, the sequence of events given complete information. Brassier claims that agents' expectations are consistent with determinism with respect to the events which such expectations concern; contra Esposito, who converts the revisability of these expectations into insights regarding ontological indeterminacy. This conversion facilitates the assignment of a temporal meaning to revisability, visible in the fact that the present future, not merely as a subjective or inter-subjective state, but rather as a mode of time, differs from the future present. It is thus that Esposito's argument rests on ultimately subjectivistic premises, manifesting a disavowed idealism. For Brassier, by contrast, a thoroughgoing determinism holds, constituted in the nomically, metaphysically, or otherwise law-like connection of the events, the subject matter of agents' expectations, which come to light in the present future, independent of such expectations. Insofar as present future differs from future present, we overcome epistemic constraints to learn of the real states and laws of which our informationally deficient subjective perspectives are partial reproductions. Accordingly, epistemic constraints ought not to be reified as ontological incompleteness. The indeterminism presupposed by Esposito in her conflation of these two perspectives, for Brassier, is effaced and tenuously substantiated, abjuring the sense she locates in Premise 5, namely the sense in which the distinction it poses commands ontological, metaphysical qua temporal import. Nor, in the case of Premise 6, does the revisability of market participants' expectations reflect anything other than informational inefficiencies.

The kernel of Brassier's critique is that a necessary condition for the parsing of future present from present future, in any way consistent with the function of these terms in

Esposito's argument, is a commitment to ontological indeterminacy or incompleteness. If one is prepared to believe that determinism holds, or that indeterminism is false, Esposito's, and by implication Malik's, argument must be unsound. Even if one is not, the discovery of highly controversial premises, sketchily if at all avowed, let alone argued for, must seriously reduce the force of their case. It is in this sense that Brassier's account would seem to pose a powerful objection to the philosophy articulated in 'The Ontology of Finance' and *The Future of Futures*.

Esposito and Brassier on temporality and determinacy

This section pushes back against Brassier's critique in a way which also casts into clearer relief the advantages of reconstructing Esposito's argument as a set of linked metaphysical propositions. The defence of Esposito's argument hinges on two key terms: endogeneity and expectations. A better understanding of Esposito's account in respect of these terms does much to refute the position that her own entails a general ontological indeterminacy or requires determinism to be jettisoned outright. Rather, the scope of her utilisation of this notion is confined to the system of expectations which serves as her model for the market for derivatives. On this view, *The Future of Futures* harbours no pretence to generality or fundamental ontology, such as would be needed for these extravagant implications to mar Esposito's perspective, or for Brassier's objections to be terminal.

The natural starting point for this demonstration is what Brassier takes to be the provenance of Esposito's alleged indeterminism: the notion of revisability. Reconsider the following two premises:

- 5) The future is the revisability of the present future and the future present
- 6) Derivatives enable the revisability of expectations (about prices)

Brassier's counterargument involves presenting a dichotomy between two possible construals of these premises. According to one construal, the notion of revisability they incorporate pertains to epistemic facts about market participants. Expectations are revised because the real dynamics of law-like price movements, and all of the data which could affect such prices, are occluded from participants at the time of formation. They face informational constraints. This, for Brassier, is a plausible statement, and consistent with his own determinist counterproposal: so interpreted, participants changing their expectations about pricing levels does not imply a change in the dynamics. However, there is a more radical construal of the sense of the term 'revisability' at work in Premises 5 and 6, which, for Brassier, is both necessary for the soundness of Esposito's argument and yet implausible, namely the general ontological construal. To the extent that real dynamics govern price movements in the transaction of derivatives at all, they are not law-like. Such, according to this interpretation, is the meaning of the claim that the present future, the future at a given present time, need not be the future present, the future at a later time. This, for Brassier, is an implausible statement, inconsistent with his determinism, for it suggests that the market is not subject to deterministic laws. Not only are these construals distinct; there is no legitimate logical relationship between them – certainly, none leading from the more to the less intuitively plausible of the two. Fatally for Esposito, the seemingly questionable second construal is, according to Brassier, a commitment which must be retained in order to license the inference to Premises 7 and 8. For Esposito's account truly to intervene in the philosophy of time, it will not do for revisability to contemplate epistemic states, but rather the events themselves.

So, how deleterious are Brassier's criticisms? It is the contention of this article that they do not successfully undermine Esposito's argument. As shown above, Brassier's objections rest on a dichotomy between conceivable interpretations of Premises 5 and 6. Contrary to this approach, though, there are alternative construals of these premises which avoid such unwelcome results. Specifically, keeping in mind the meaning of Premise 1 clarifies the meaning both of expectations and of revisability in Premises 5 and 6 in a way which weakens Brassier's objections. To reiterate, Premise 1, the Endogeneity Thesis, asserts that time-relations are internal features of systems. The system which is germane to Esposito's analysis is the system of market participants' expectations. The practice of derivatives trading, such as buying or selling options, as described above, attests to the essential function of these. Importantly, given Premise 1, the distinction of future present and present future, and of the temporal content which imbues Esposito's account, encompasses just these expectations; this distinction distinguishes time-relations, and time-relations belong to the system. As Brassier himself remarks:

Time, on this account, is always system-specific, in that the maintenance within the present of past and future presents depends entirely on the structure, organization, and capacities of any given system. (Brassier, 2017: 95-6)

Limiting the scope of Premises 5 and 6 to systems of expectations opens up a line of defence against Brassier. The revisability to which these premises allude is the revisability of expectations, and therefore precisely the kinds of subjective or inter-subjective phenomena he does concede as legitimate objects of the peculiar dynamics Esposito finds in the operation of the market. From this, though, the wider conclusion he imputes to Esposito, the subjection of 'outcomes' in general to the dynamic of revisability with an unrestricted scope, does not follow. In the above formalisation of the doctrine, for instance, with the distinction between P_F and P being used to illustrate revision, they are clearly the expectations of a market participant, initially set at a level P , which are revised in the future present, at which time some other price P_F obtains. Expectations are formed and revised about the (present future) price of a security at a future time: "Constraints introduced in the present are subsequently revised in the context of a control that evaluates and corrects them" (Esposito, 2011: 27-28).

Yet the requisite logical link between this thesis and ontological indeterminism is absent both from this argument and from Brassier's attack. Whilst an exhaustive or at all comprehensive account of the various formulations of determinism is clearly beyond the scope of this article, there are a number of strong indications that this is indeed a non-sequitur. Brassier's suggestion is that the distinction between present future and future present is used to derive the inscription of indeterminability (Brassier, 2017: 95-6). Here it is assumed that usages of 'indeterminability' and 'indeterminacy' are synonymous and that both imply philosophical indeterminism. As such, Premise 5 is the premise alleged to disguise latent indeterminism. But is this allegation merited? Consider, for instance, Russell's (1913: 199) canonical presentation of determinism:

A system is said to be 'deterministic' when, given certain data, e_1, e_2, \dots, e_n , at times t_1, t_2, \dots, t_n respectively, concerning this system, if E_t is the state of the system at any time t , there is a functional relation of the form $E_t = f(e_1, t_1, e_2, t_2, \dots, e_n, t_n, t)$.

Russell defines determinism as a functional relation between events and the times at which they occur. Such events, in the present case, could be the spot prices of a given security at various times. For Brassier's accusation to succeed, Esposito would have to debar any relation

between a set of states at one point in time and a set at another point, such that the former is functionally related to the latter. But it is not at all obvious that this prospect is in this way debarred by a theory which concerns participants' expectations. Remarks about the expectations of market participants simply do not prescribe the absence of such a functional form, nor any other intuitive meaning of determinism or determinability which fits Brassier's usage.

It is therefore questionable whether the indeterminism Brassier has in mind as regards Esposito is legitimately imputed. There is no doubt that contingency and indeterminism are prominent themes within the theoretical milieu in which Esposito's discussion figures, and as noted earlier, a number of prominent voices in this field have addressed them. This imputation may well be justified in the case of Brassier's discussion of Malik's essay, which contains meaningful references to different types of contingency. Indeed, there are even aspects of *The Future of Futures* which adopt an ambivalent stance with respect to indeterminacy.⁶ But, distilled to its essence, Esposito's argument does not entail or presuppose a commitment to ontological contingency or indeterminism. Her overall position is sufficiently nuanced to resist simplistic *précis* or perfunctory assimilation to traditional doctrines in the philosophy of causality and, for the purposes of the present analysis of the role of time in financial markets, there is insufficient evidence of the problematic commitment to ontological indeterminism alleged by Brassier for this to amount to a terminal objection to the argument reconstructed here.

And so, relativising Esposito's conclusion to the restricted domain of participants' expectations secures her account from unfeasible metaphysical import. Revisability is a characteristic of the time-relations specific to the system of expectations belonging to the market. She does not endorse a generalised indeterminism in so doing. However, this relativisation introduces another threat for Esposito's case. Whilst her square and forthright focus on the domain of expectations may well indeed yield a more defensible argument, it may also result in a loss of generality, her argument becoming more parochial and less metaphysically impactful. To clarify the provenance of this threat, consider the divergent implications for the conclusion of her argument which obtain depending on whether they are or are not limited to systems of expectations:

7) Derivatives sell the future

8) Derivatives transact time

Is the force of Premise 7 not reduced somewhat if the sale of the future amounts to enabling the revisability of expectations, rather than the future taken in its wider philosophical sway? Does it not then become a proposition which belongs more properly to the philosophy of mind, to empirical psychology, to the anthropology of markets, or to behavioural economics, than to the philosophy of time, or the metaphysics of markets? It might seem that the gain in plausibility hard won by the narrowing of its scope is by the same token offset by its reduced materiality: the claim is either implausible or unimportant.

The insight which dispels this antinomy and, in so doing, restores these reflections on the temporality of derivatives from abstraction to philosophical import – whilst nonetheless preserving them from the excesses which would involve an abrogation of determinism – is the indispensable category of *The Future of Futures*: that of expectation. Esposito's conception of expectation is one which both holds it to be subject to the Endogeneity Thesis and grants it a meaningful ambit, a status which limits its scope without negating its force. It has neither the ramifications for the kind of determinism which might obtain in the classical sciences, and

which might commit it to absurdity, nor such austere restraint as might lead only to platitudes. This should not in itself be surprising, given the purposes Esposito attributes to her work, namely, to exhibit connections between the temporal characteristics of the dynamics of economy and disruptions among the most drastic and concrete of those witnessed in recent years:

The exploitation of temporal relations, the ‘mortgage on the future’ for present purposes ... allows for the use of the insecurity of the future for the generation of present security. However, it loses sight of the role of time in the economy, as recurrent crises will force us to remember. (Esposito, 2011: 26)

So, how does the notion of expectation balance these competing demands, plausibility and generality, specificity and relevance? The subject matter of the trade in derivatives consists in expectations – more precisely, expectations about expectations. Consider again Premises 7 and 8 in their relation to these expectations. Derivatives sell the future as revisability of expectations. Expectations about prices themselves constitute financial systems, as per Premise 2. Since the value of financial instruments and therefore the dynamics of this system depend on these expectations, declarations about the temporality of expectations relate directly to the system and the forces which populate it. These forces which comprise the sub-structures of the financial system effect their own proper time. Expectations are not, therefore, the abstract subject matter of an idealism, but the very engine of the decisions which drive demand, the management of needs, and the economy itself – just as, Esposito notes, the Austrian School, Keynes, and others had held, highlighting the need for a “general theory of expectations” (Esposito, 2011: 15). This is the sense in which Esposito’s analysis of the temporality of these systems is broad enough to be relevant. However, importantly, it does nothing to usurp the possibility of giving separately a deterministic or other analysis of these dynamics – of the relation between participants’ expectations at a given time and the future state of the market, such as would be encapsulated in price levels. It is not, therefore, inconsistent with Brassier’s contention that the trader’s contingent psychological states can figure in an account of price movements or other market dynamics. This is the sense in which Esposito’s analysis remains plausible, and specific, enabling it to be successfully defended from Brassier’s objections.

Conclusion

What, then, is the upshot of Esposito’s theory? If, as she says, financial markets have a metaphysical status, the hypertrophy of the most arcane transactions they enable impinges upon the fabric of time. The temporal disruptions which ensue are characterised by a variety of topological allusions which crop up in Esposito’s work, from reflection and mirroring, illustrating the reflexivity and recursion of expectations, to loops and folds in time: “the recursive form of the intertwining of constantly renewed horizons” (Esposito, 2011: 24-25). Derivatives incorporate the recursive structure of revisability; the expectations formed at a given moment relate only to others’ expectations, losing their grip on the qualities of their underlyings and accelerating the liquefaction of prices. In effect, expectations become functional on expectations, forming a quasi-independent system or singularity. Influences propagate between discontinuous points in time; expectations, demands, and needs lose touch with objects and focus only on themselves; seemingly obdurate economic history comes to depend upon the future, because of the increasing commodification of revisability. As Frankel and Ossandon declare in their review of Esposito:

In this sense, economic history can be seen as a series of folds, or structural distinctions: from things to private property to money to derivatives. (Frankel and Ossandon, 2013: 277)

The metaphysical import of these developments in financial markets, then, outstrips the already problematic reality of extreme volatility, financial crisis, and resultant collective immiseration. They impinge upon the time proper to these markets since the foci of the transactions, being revisions to expectations, are time-relations themselves, “built as a mirroring of possibilities that open and close where the future includes a future present from which I can look at my present as past” (Esposito, 2011: 27).

In this way, Esposito’s research provides a new lens for investigating the foundations of financial society and derivative finance. Whilst scholars working on the foundations of finance in the last decade have without a doubt unearthed significant metaphysical content latent in its theoretical assumptions – from the contingent (in)accuracy of pricing models, to the interrelation of theory with actual trading – the revisability of pricing proposed by Esposito, originating in participants’ expectations, entails new metaphysical conclusions about time, and illustrates how time is fashioned into a tradable object. As Esposito concludes, the task which confronts researchers and theorists working in these domains is to cognize, rather than to efface, the circular and self-referential characteristics of markets which serve to proliferate these derivative instruments. For philosophers, a different conclusion obtains. Whether or not through academia, implicit metaphysical beliefs about time intermix with real actors’ decision making, producing tangible ramifications, making the peculiar time-dynamics of the systems involved urgent objects of philosophical enquiry. Quite to the contrary of Marx’s dictum from *Theses on Feuerbach*, in which philosophy contributes only interpretation and never concrete change, these time-dynamics, uninterrogated, become the very impediments of such change.

Notes

1. Esposito (2011: 9): “The formula only worked so well because, for a certain time, volatility adjusted to the estimates of the formula, not because it predicted the actual movements of volatility”.
2. This aspect of Esposito’s presentation follows the extensive analysis of reflexive and recursive market expectations given in Soros (1987).
3. It must be acknowledged that Esposito’s discussion of ‘time-binding’ is, in turn, drawn from the work of Niklas Luhmann (1981: 126-50; 1991: 51-72).
4. For an account of this type of position, see Hull (2002: 194-96).
5. It should, however, be acknowledged that Brassier’s relationship with this moniker is sophisticated and that he has recently distanced himself not only from the movement, but also from its reification as a unitary movement. For more on this, see Brassier (2011) or Gratton (2014: 254).
6. The following statement is not the only one which attests to this complex ambivalence: “The future is, therefore, both determined and indeterminate at the same time” (Esposito, 2011: 26). See also her other comments on pages 9, 11, 14, and 25.

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