Economic Profiling of the Lone Wolf Terrorist:

Can Economics Provide Behavioural Investigative Advice?

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Economics has long had a theory of 'crime and punishment'. This theory provides predictions about the effects of law enforcement activity on criminals' actions but can it provide investigative advice? This paper extends the theoretical framework by identifying the possibility of 'economic profiling' of criminals and terrorists. Investigative psychologists attempt to derive the characteristics of offenders from the characteristics of the crime to develop an offender profile. The assignment of individuals to a 'class' involves the application of a classification scheme or typology. If the characteristics of a crime can be assigned to a particular type, the offender will have certain characteristics. This may assist law enforcement in identifying and finding the offender. A logical extension of the expected utility analysis of crime and terrorist behaviour is the development of a methodology of economic profiling based upon an economic-behavioural typology of criminal and terrorist behaviour. It is the purpose of this paper to provide some first steps in the development of such a framework. These first steps are cast in the context of an investigative economist seeking to develop an economic profile of a lone wolf terrorist.

Key Words: economics, crime, terrorists, profiling, offenders, investigative psychology, expected utility, criminal behaviour, terrorist behaviour, typology, investigative economist, economic profile, lone wolf terrorist.

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I. Introduction

Offender profiling involves the construction of a profile of the offender from the characteristics of the crime or crime scene. The objective of offender profiling is to assist law enforcement to identify and find the offender. The profile may also help law enforcement to provide more precise warnings to the public about the possibility and nature of future offences—to be alert to a particular type of individual or to be especially alert at particular times or places. There are a number of approaches to offender profiling and the emerging discipline of investigative psychology is a field very much characterised by rigorous debate. Whatever the outcomes of this debate may be, there is surely value in asking whether the concept of deriving offender characteristics from the characteristics of the crime is something to which economic science can contribute. This involves a logical extension of the ways in which economics is applied to criminal behaviour and amounts to asking the following question: Given information about a crime, can economics provide investigative advice? The answer is yes, it can. By extending the economic theoretical models of crime and terrorism, is the purpose of this paper to show how, in principle, economics can provide investigative advice to law enforcement involved in the pursuit of lone wolf terrorists.

The 'lone wolf terrorist' has been selected for special attention in this paper because, in many respects, recent analysis of the lone wolf terrorist comes very close to providing investigative advice to law enforcement. The economics of terrorism is a combination of unique applications of economic theory—usually game theory and expected utility theory—and extensions of the economic theory of crime developed by Becker (1968) and Ehrlich (1973). Economic analysis of terrorism has generated a number of useful insights into the patterns and behaviours of terrorists. It has also swept aside some of the conventional wisdom that tends to be reflected in popular perceptions of terrorism. Phillips (2011), in an analysis of lone wolf terrorism, appears to go one step further in attempting to 'ensnare' the lone wolf within an analytical framework such that the lone wolf's behaviour is not only explained within a rational choice framework but, with reference to a benchmark risk-return matrix, anticipated in a manner that touches on providing investigative advice to law enforcement. With these theoretical 'footholds' established within the literature, lone wolf terrorism provides a practical starting place for a research program that may eventually extend to other types of illegal behaviours.

The lone wolf terrorists that continue with their activities over time and evade capture by law enforcement exhibit the 'serial' offender behaviours that are most often the subjects of investigative psychology. Although it is, of course, possible to develop a profile of an offender from a single crime scene, the distinct style of the offender may become clear only after a series of crimes has been committed (Canter et al. 2004). As Canter et al. (2004, p.303) explain, the early crimes (usually the first and second) may be expected to be exploratory and may not reveal the offender's distinct style. The offender may also develop skills and experience as a result of undertaking these exploratory criminal activities, especially through his interactions with the victim, the reaction of the victim and the nature of law enforcement reactions. If offenders have a style that can be classified according to a particular classification scheme or typology, this style may be more likely to emerge over a series of offences (Canter et al. 2004, p.303). The serial behaviour of lone wolf terrorists provides an appropriate context within which to explain the nature of economic profiling. The danger that lone wolf terrorists represent,

a danger that is recognised by the Federal Bureau of Investigation (FBI), is an additional factor that adds to the value of investigating the behaviour of these individuals. If economic science can contribute, even marginally, to the provision of investigative advice that assists law enforcement in the pursuit of lone wolves, the analysis will be amply justified.

Apart from the possibility of extending the scope of economic analysis of criminal and terrorist behaviours and, potentially, assisting law enforcement in identifying, apprehending and curtailing the activities of these individuals, there is another way in which economic science may contribute to the body of knowledge that is accumulating around the concept of offender profiling. Snook et al. (2008, p.1260) argue that the (psychological) theory underlying offender profiling is weak. In some cases, profilers may be implicitly or explicitly adopting flawed theoretical frameworks or theoretical frameworks that are not well supported by empirical evidence. By contrast, the economic theory that would underlie 'economic profiling'—profiling based on an expected utility theoretical framework—is both rigorous from a purely theoretical standpoint and supported by empirical work. As an example, consider Landes' (1978) well-known study of hijacking. The expected utility model presented by Landes (1978) and based upon Ehrlich and Becker's contributions to the economic analysis of crime, appears to be well-supported by Landes' (1978) empirical analysis of hijacking and the reactions of hijackers to increased airport security and prison sentences. That part of an offender's profile that may be constructed on the basis of economic analysis is likely to stand on relatively firm ground.

The remainder of this paper is organised as follows. In Section II, a review of the relevant literature is presented. The literature review concentrates on studies of offender profiling and investigative psychology. In Section III, the possibility of economic profiling is explored. This exploration relies upon extracting pieces of investigative advice from the 'economic typology' that is embedded within expected utility theoretical analysis of crime and criminal and terrorist behaviour. The ways in which an economic theoretical framework may complement the statistical approach to offender profiling that is deployed by investigative psychologists and profilers is discussed. In Section IV, this theoretical work is applied to the analysis of serial lone wolf terrorists in both the United States and Europe in order to show how economic analysis may provide investigative advice to law enforcement in particular cases. In Section V, conclusions are drawn and directions for future research are offered.

II. Literature Survey

A. What is Offender Profiling?

Offender profiling is about drawing inferences about the offender from the crime and crime scene. More formally, $A \rightarrow C$, where A are the actions that occur in and are related to a crime and C are the characteristics of the offender (Canter 2004, p.5). The drawing of inferences for C from A is encompassed within the symbol '$\rightarrow$'. This is where all of the scientific modelling and processes underlying offender profiling sit (Canter 2004, p.5). The scientific modelling and processes that are designed to facilitate the drawing of inferences for C from A now constitutes a relatively large literature that may be broadly classified under the emerging discipline of investigative psychology and offender profiling. The discipline and its main subject, offender profiling, have

relatively brief histories, though early examples of profiling can be found. According to Douglas et al. (1986), Canter (2004) and Alison et al. (2010), the origins of offender profiling are traced to the Federal Bureau of Investigation's (FBI) Behavioural Science Unit in the 1970s where agents began to draw on all information related to a violent offence and, in combination with their investigative knowledge and experiences, draw inferences about an unknown offender. The process has since been popularised in movies and TV series, leading to an interesting situation of a science evolving alongside its popular counterpart.

B. The Evolution of Investigative Psychology

Alison et al. (2010) identify three different approaches to offender profiling: (1) the criminal investigative approach; (2) the clinical approach; and (3) the statistical approach. Each approach draws on a different type of 'knowledge domain' on the basis of which inferences about the offender are drawn. The similarity between the approaches is the argument that it is possible to identify 'reliable clusters of crime scene behaviours' that may be used to develop taxonomic or typological classifications. These taxonomies or typologies may then be applied in each case to develop a profile or portrait of the offender given the characteristics of the crime and crime scene. The criminal investigative approach, developed by the FBI in the 1970s, traditionally combined information about a violent offence and investigative knowledge to develop an offender profile. This mixture of tacit knowledge and experience has been developed into a more formal set of typologies that are, in principle, empirically falsifiable (Alison et al. 2010, p.117). The clinical practitioner approach, like the criminal investigative approach, has traditionally been a mixture of experience and tacit knowledge but from a clinical practitioner's knowledge-experience base rather than a law enforcement knowledge-experience base. Finally, the statistical approach is characterised by the application of various statistical techniques (especially spatial analysis) to information concerning crimes and crime scenes with the objective of both developing and empirically testing the validity of classification schemes or typologies (Alison et al. 2010).

As these three approaches have merged, blended and been subjected to careful analysis over two decades, offender profiling has, according to Alison et al. (2010) become a broader multidisciplinary approach to the provision of behavioural investigative advice (BIA). This evolution has not been characterised by a complete replacement of the tacit knowledge of investigators and clinical practitioners with scientifically rigorous typologies and methodologies. Rather, it seems that a scientifically based but pragmatic approach to determining the best methodology with which to construct behavioural investigative advice has come to characterise the field of offender profiling and investigative psychology (Alison et al. 2010, p.127). The state-of-the-art in offender profiling is a much more informed and rigorous discipline based on theoretical and practical knowledge and experience. With more clearly defined and sounder theoretical foundations permitting the application of informed statistical analysis, offender profiling has matured into a more scientific discipline that, at the very least, has been able to put forward some evidence-based methodologies for the provision of behavioural investigative advice. As one would expect, however, the processes by which inferences may be made about the offender from characteristics of the crime and crime scene and the validity of various contributions from theory, investigative or clinical experience and empirical-statistical studies are still the subject of much debate.

C. Approaches to Inference

One aspect of investigative psychology that is subject to strong debate is the approaches to inference. The transition from **A** to **C**, involves some process. In the early stages of the development of investigative psychology this process was somewhat more characterised by the drawing on of tacit investigative or clinical knowledge. As investigative psychology and offender profiling developed as an academic discipline, a number of models and processes emerged to provide structure and rigour to the process of developing inferences about an offender from actions that occur in or are related to the crime. Canter (2004, p.5) lists five possibilities: (1) Personality theory; (2) Psychodynamic theory; (3) the career route perspective from criminological theory; (4) social processes; and (5) Interpersonal narrative theory. Traditionally, the dominant process has been some application of personality theory though, as Canter (2004) explains, the other processes by which inference about the offender may be made have recognised value. As offender profiling extends beyond the personality profile of the offender to a 'geographic' profile—designed, for example, to locate the offender's likely place of residence—other processes and models become applicable (O'Leary 2009). In fact, the choice of models and methods, each based upon particular psychological models, is quite large. Goodwill et al. (2009), for example, examine three such models: (1) the FBI's Power and Anger Model; (2) Canter et al.'s (2003) Behavioural Thematic model; and (3) the Massachusetts Treatment Centre's Rape classification system. Each approach again reflects the different perspectives of the investigators and researchers concerned. The goal, in each case, is the same. This is the classification of offenders in order to prioritise suspects (Goodwill et al. 2009).

D. The Importance of a Classification Scheme or Typology

The classification of offenders to a particular 'type' lies at the heart of the problem of drawing inferences about an offender from the characteristics of a crime or crime scene. As Canter (2004, p.8) explains, "A recurring consideration in the emerging investigative psychology literature is therefore the development of classification schemes, often in the form of typologies, into which offences and offenders can be assigned." If the crime or crime scene can be classified as a particular type, the offender will have the characteristics associated with that type. Canter (2004, p.8) identifies two critical assumptions that underlie the typologies: (1) within each type, the characteristics that define that specific type are likely to co-occur with one another with regularity; and (2) specific characteristics of one type are assumed not to co-occur with the characteristics of an alternative type. The development and empirical testing of these typologies constitutes a relatively large part of the investigative psychology literature. Although only limited empirical support for typologies has been found, the spatial analytical methods deployed in the analysis of crime scene characteristics have generated a large amount of information that will need to be assessed and reassessed as debate about the underlying psychological-theoretical models continues.

As may be expected, however, from a field that is both scientific and pragmatic in nature, a dominant typology retains a place of prominence within both the academic literature and law enforcement practice even in the absence of strong empirical-statistical support. This is the organised/disorganised typology. The organised/disorganised typology is identified by Canter et al. (2004, p.293) as one of the "most widely cited classifications of violent, serial offenders." This is probably due to the fact that although direct empirical support for the organised/disorganised typology is weak, empirical investigations of this and related typologies

have revealed at least some support for the possibility of using crime and crime scene information to analyse the 'themes of actions' and linking these 'themes' to the characteristics of the offender (Salfati and Canter 1999, p.405; Canter 1994). This is mirrored in a detailed empirical investigation of the organised/disorganised typology undertaken by Canter et al. (2004) in which the authors found that serial murders were almost always characterised by a particular subset of organised characteristics. No evidence was found for a 'disorganised type' with disorganised features having far lower frequency. Although support for an organised/disorganised dichotomy was weak, the analysis revealed that rather than a simple dichotomy, serial offenders may be distinguished by the ways in which they are disorganised. If all serial murderers exhibit similar organised features but particular disorganised features, there may be structure conducive to some typology embedded in the different ways in which serial killers exhibit disorganised aspects of their activities (Canter et al. 2004, p.313). These 'glimpses' of structure appear to have been sufficient, when combined with investigative knowledge, to ensure the continued utilisation of the organised/disorganised typology within law enforcement agencies.

E. Other Typologies and Empirical Analysis

Investigative psychology and offender profiling is about making inferences: **A→C**. The 'inference processes' represented by '→' are based upon a variety of different psychological models which inform a classification scheme or typology that is designed to place an offender in a particular 'type' in order to prioritise suspects and assist law enforcement with investigation. As we have seen, there are a variety of psychological models and classification schemes extant in the investigative psychology literature and the ones that we have covered far from exhausts the complete list. Part of the investigative psychology literature is devoted to empirical testing of the various models and typologies and their underlying assumptions (for example, Salfati and Canter 1999; Mokros and Alison 2002; Dabney et al. 2006; Goodwill et al. 2009). Another related part of the literature is devoted to identifying 'structure' within **A** to further guide the construction of typologies. Interestingly, an important part of this endeavour is the deployment of multivariate analysis and, in particular, spatial analytical techniques (for example, Canter et al. 2004; Häkkänen et al. 2004; Häkkänen 2006; Goodwill et al. 2009; Chambers et al. 2010; and Zaitsu 2010). The available evidence appears to support the possibility of offender profiling but this is certainly not a unanimous position within the investigative psychology and offender profiling literature.

F. Is Offender Profiling Possible? Criticisms and Caveats

"There is a growing belief that profilers can accurately and consistently predict a criminal's characteristics based on crime scene evidence. This increased belief is evident from the fact that [offender profiling] is becoming prevalent as an investigative technique, that positive opinions of [offender profiling] are being communicated in the published literature and that police officers and mental health professionals support the use of [offender profiling]" Snook et al. (2008, p.1270). Snook et al. (2008) argue that there is an absence of 'compelling' scientific evidence that offender profiling is reliable, valid or useful. The authors argue that the belief that offender profiling 'works' is an illusion deriving from the mixture of fact and fiction that has characterised offender profiling since its inception. Simply, the anecdotal evidence in favour of offender profiling is given too much weight relative to the scientific-empirical support for offender profiling. This has led to the premature

acceptance of offender profiling as an investigative technique (Snook et al. 2008, p.1270). The authors argue that this is pernicious given the possibility that a method that is theoretically and empirically lacking in support may mislead investigators, hinder the investigative process and lead to wrongful convictions (Snook et al. 2008, p.1270). Snook et al. (2008) do not deny the possibility of offender profiling but direct their critique at the adoption and application of an approach that requires much more analysis and try to explain why offender profiling has gained widespread acceptance in the absence of compelling theoretical and empirical support. They conclude that, while offender profiling may be possible, more research is required (also see Snook et al. 2007).

Of course, a critical approach to all evidence is a hallmark of good science. The offender profiling literature and the scientific evidence (one way or the other) that it documents has emerged alongside both a popular conception of offender profiling and an evolution in the practical application of offender profiling that is at once both pragmatic and scientific. The result of all of this is that particular aspects of offender profiling—for example, particular typologies—have demonstrated weaknesses while simultaneously the same studies find structure within the available crime and crime scene data. Alongside this scientific evidence rests the knowledge and experience of law enforcement officers which, when combined with scientific evidence and theoretically guided approaches, may generate useful results. One approach to tying the loose threads of offender profiling together is embracing the pragmatic-scientific nature of offender profiling (Alison et al. 2010). As Snook et al. (2008) recognise, offender profiling might work and law enforcement continues to expand the deployment of the tool. A hiatus in this deployment pending further investigation is unlikely to be feasible. This is, however, not an unmanageable state of affairs. Scientifically-based pragmatism does not mean that offender profiling will not be guided by the available theoretical and empirical evidence. It means that, in practice, the deployment of offender profiling will probably not be constrained by it.

G. Conclusions from the Literature: A Place for Economics and Rational Choice
Several features that characterise offender profiling provide starting points for a contribution from economic science. First, although there is still much debate, the available evidence appears to point in the direction of some underlying structure to criminal activity. This is particularly the case for certain types of crimes. Second, a point of weakness in the process of offender profiling is the stability and rigour of the underlying theoretical framework. Although we do not expect economic science to provide a complete theoretical framework for offender profiling, the comparative rigour of the expected utility rational choice theoretical framework may contribute positively as a stable component of the overall theoretical structure underlying offender profiling. Furthermore, a typology or classification scheme derived from an expected utility rational choice theoretic framework would benefit from the rigour of the underlying economic theory. Third, there are almost certainly parallels between the statistical analysis that has come to characterise the 'third-phase' of offender profiling and the statistical-empirical analysis that is utilised in economic science. There is no reason why economic science cannot contribute to the development of offender profiling by providing an additional viewpoint from which to analyse and interpret the results of the types of multivariate statistical and spatial analysis undertaken within the field of investigative psychology. Even if the contribution of economic science must be pragmatic-scientific in nature, even marginal contributions to the efforts of law enforcement may be useful.

In principle, economic profiling or the drawing of inferences for an offender from crime and crime scene information on the basis of an inference process based upon an economic theoretical framework and an associated economic typology is possible because of the structure exhibited within the crime and crime scene data. Where there is motivated action that is not completely random, economic science can provide an explanation for at least a part of that action. Further support for this contention is to be found within the investigative psychology literature where there is some evidence to suggest that a 'rational choice' approach may be beneficial and may both overcome some of the problems associated with other inference processes of offender profiling and link together some of the approaches to offender profiling. Beauregard et al. (2007) develop an approach to offender profiling that views criminal action in terms of a 'hunting process', which includes hunting patterns (see Rossmo 2000) and cognitive, behavioural and geographic aspects of the crime (Beauregard et al. 2007, p.1070). The hunting process guides the development of a classification scheme or typology in the form of a 'script'. The provision of investigative advice is based upon these 'hunting process scripts' which may be compared with the crime and crime scene evidence in order to determine the type of individual responsible for a particular series of crimes.

One of the apparent advantages of the rational choice, hunting process, approach to offender profiling is its capability at handling cognitive and behavioural factors as well as situational factors. As Canter (2004) noted, the task of constructing a geographic profile for an offender may require the application of inference processes that differ from those used to construct a psychological profile. Beauregard et al. (2007) encompass hunting patterns, cognitive, behavioural and situational variables within rational choice-based hunting process scripts that may be used as the basis for constructing a more complete offender profile. An approach to offender profiling that is based upon economic science may extend these results by the deployment of a more rigorous theory of rational choice: expected utility theory. The apparent structure of criminal action, the open debate that characterises the field of investigative psychology and offender profiling and the multidisciplinary nature of the exercise provide an opportunity for a contribution from economic science. Undertaking to provide such a contribution may also extend the ways in which crime and criminal behaviour is analysed within economics. Even if the ideas are necessarily embryonic at first, it would be very useful to show that economic science is capable of providing some form of investigative advice.

III. An Economic Approach to Developing an Offender Profile

We shall explore two economic approaches to developing an offender profile. Both are based on traditional economic analysis and substantive rationality. However, in making recommendations for future research we shall recommend exploring an alternative approach based on Herbert Simon's procedural rationality (see for example, Simon 1978). Of course, there are likely to be other possibilities and many extensions to the approaches that are presented in this section. When it comes time to provide some directions for future research, some of these other possibilities and extensions will be pointed out. Because the context of this analysis is lone wolf terrorism, other ways of approaching the construction of an economic profile may naturally emerge when other contexts are carefully analysed. In this section, the expected utility theory that underlies the analysis of

crime and terrorism is the starting point for an analysis that generates a number of pieces of investigative advice. This general formal analysis is examined within a particular empirical context in the following section where some well-known lone wolf terrorists are studied in light of the investigative advice generated by economic science.

A rational economic actor ranks possible choices according to their expected payoffs. A formal way of representing this preference ordering is by the agent's utility function. The arguments of the utility function represent the factors that contribute positively or negatively to utility. In the presence of uncertainty, the von Neumann-Morgenstern (NM) expected utility (EU) function weights the possible outcomes of risky choices. The rational agent chooses among possible choices in a manner that maximises expected utility. This is different from saying that the agent maximises his or her expected payoff. Very risky choices with high payoffs may be accorded a lower expected utility than less risky choices with lower payoffs. The specification of the actor's expected utility function and the risk preferences that are embedded within it will determine, in each case, whether the actor will make high risk or low risk choices. The arguments contained within the utility functions deployed in analytical work will depend upon the type of behaviour and scenarios being investigated. Phillips (2009; 2011) has deployed a utility function based upon two arguments: the mean or expected payoff of a particular risky choice and the variance or risk of that choice. This particular approach will agree exactly with the von Neumann-Morgenstern axioms for rational behaviour when the utility function is quadratic but has been shown to accord approximately with a large number of alternative specifications. The mean-variance approach has the added advantage of producing computable or numerical results rather than purely formal conclusions.

A. Substantive Rationality: Standard 'Economics of Crime' Approach

Although Becker's (1968) work is better known, Ehrlich's (1973) expected utility model of participation in illegitimate activities is a better starting point for the construction of an economic profile. Both Becker's (1968) model and Ehrlich's (1973) model share similar foundations and either could be used as the theoretical foundation for economic profiling but Ehrlich's analysis contains threads that may be taken up in order to develop an economic framework capable of producing investigative advice. It is, therefore, the most expedient starting point. Like the investigative psychologists, the economists recognised that it was not possible to generate predictions regarding the outcome of objective circumstances from a theory of criminal behaviour based on a motivation unique to the offender (Ehrlich 1973, p.522). Ehrlich (1973, p.522) begins from the proposition that even if offenders differ systematically from law abiding citizens, they do respond to incentives: "Rather than resort to hypotheses regarding unique personal characteristics and social conditions affecting respect for the law, penchant for violence, preference for risk, or in general preference for crime, one may separate the latter from measurable opportunities and see to what extent illegal behaviour can be explained by the effect of opportunities given preferences" (Ehrlich 1973, p.522).

Ehrlich's (1973) model is relatively straightforward and, like most traditional economic analysis, is focussed on aspects such as wealth, resources and income. At first, this seems to reduce its relevance to 'crimes against the person' and terrorism. However, this may be circumvented in different ways. Within defence economics, analysis that is based upon this traditional economic theory of involvement in illegitimate behaviour, including

terrorism, is sometimes treated with the analytical concept of 'wealth equivalents' (see Enders and Sandler 2002). This is the approach that is taken herein but we follow Ehrlich's (1973) formalism. Ehrlich (1973) carefully constructs his analysis on the basis of the wealth equivalents generated by two types of activities: illegal and legal activities. In many ways, Ehrlich's model is one based on negotiating a 'time constraint'. The individual has limited time to spend on illegal and legal activities and non-market activities such as consumption and leisure. In this paper, we imagine a lone wolf terrorist who must decide how to divide his time between illegitimate terrorist activities and legal political activism.

Ehrlich's (1973) offender is one who faces a decision problem involving the optimal allocation of resources to competing activities—illegitimate and legitimate activities—under conditions of uncertainty. The activities are not mutually exclusive. For the purposes of this analysis, we shall describe our offender as an individual involved in the 'illegitimate activity' of lone wolf terrorism. Enders and Sandler (2002, pp.145-146) define terrorism as: Terrorism is the premeditated use or threat of use of extranormal violence or brutality by subnational groups to obtain a political, religious, or ideological objective through intimidation of a huge audience, usually not directly involved with the policy making that the terrorists seek to influence." Phillips (2011, p.3) suggests: "A lone wolf terrorist engages in operations that are consistent with the definition of terrorism but does so outside of a formal command or organising structure. The lone wolf may or may not sympathise with a particular terroristic organisation and may not be motivated by a completely unique ideology or objective[1]." The targeting of non-combatants or citizens is a defining characteristic of terrorism. Lone wolves may be particularly dangerous and, like other serial offenders, may be particularly adept at evading law enforcement. However, the lone wolf's motivated action leads him directly into the analytical framework of economic science.

The lone wolf, following Ehrlich's (1973) expected utility theoretical framework, maximises the expected utility function:

$$EU(X_s, t_c) = (1 - p_i)U(X_b, t_c) + p_i U(X_a, t_c)$$

(1)

Subject to a time constraint:

$$t_0 = t_i + t_l + t_c,$$
$$t_i \geq 0; t_l \geq 0; t_c \geq 0$$

(2)

Where X_s is the stock of a composite market good (assets, earnings and *real wealth equivalent of non-pecuniary returns* from legitimate and illegitimate activity) (Ehrlich 1973, p.525) contingent on the state of the world s; t_c is the amount of time spent on non-market activity; t_i is the amount of time spent on a risky illegitimate terrorist activity; t_l is the amount of time spent on safe legal activity such as legitimate political activism; U converts X_s

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[1] See Instituut voor Veiligheids en Crisismanagement (2007).

and t_c into consumption flows. In a single period model, there are two states of the world, a and b, giving the lone wolf X_a or X_b and the returns to the lone wolf are expressed by:

$$X_b = W' + W_i(t_i) + W_l(t_l)$$

$$(3)$$

$$X_a = W' + W_i(t_i) - F_i(t_i) + W_l(t_l)$$

$$(4)$$

W denotes net returns (pecuniary and non-pecuniary) to each type of activity. Because illegitimate activities are risky, a failed terrorist action will be associated with a diminution in returns by amount $F_i(t_i)$, which is the discounted pecuniary and non-pecuniary value of the penalty for the illegitimate activity and other related losses (Ehrlich 1973, p.525). This theoretical framework is usually used to draw conclusions about the direction and magnitude of response of offenders to changes in opportunities and law enforcement activity (see Ehrlich 1973, pp.522-523). The extension proposed in this paper is to utilise this theoretical framework to draw inferences about the offender from known characteristics of his terrorist actions. That is, to construct an offender profile on the basis of an underlying economic theoretical model that may be used to provide investigative advice to law enforcement in order to assist in the identification of the lone wolf and to provide specific warnings to citizens about the possible behaviour of the lone wolf.

What are the types that emerge from this theoretical framework? What classification scheme emerges? The classification scheme or typology that emerges from a logical extension of Ehrlich's (1973) economic theoretical framework is one based on the risk preferences of individual lone wolves, their actions under the time constraints that constitute an important component of Ehrlich's theoretical work and their allocation of time and resources to market and non-market activities. An economic profile of a lone wolf terrorist would be constructed by 'working backwards' (or drawing inferences) from the lone wolf's terrorist activities to the typology. Once the lone wolf's activities have been linked with a particular 'type', the logical-economic theoretical framework should permit conclusions to be reached about the characteristics of the unknown lone wolf and his likely future actions. This is a process by which the lone wolf could be said to have been ensnared within an economic theoretical framework.

A lone wolf who maximises the expected utility function expressed in Equation (1) will exhibit different choice behaviour depending on his risk preference and the lone wolf's risk preference shapes, among other things, the time that is allocated to legitimate and illegitimate activities. Working backwards from the nature of the lone wolf's terrorist activities, an economic profile of the lone wolf may be constructed that will fit the lone wolf to a particular type. The profile is based on a typology that must be constructed by first working forward from the theoretical framework to examine the types of activities that particular types of lone wolves will engage in. Starting from Equation (1) in an economic theoretical context characterised by two states of the world and a single period[2], the first order conditions are given by Ehrlich (1973, p.526):

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[2] See Ehrlich's (1973, p525), especially footnote six for a comment on multiple-periods.

$$\frac{\partial EU}{\partial t} - \lambda \leq 0$$

$$\left(\frac{\partial EU}{\partial t} - \lambda\right) t = 0$$

$$t \geq 0$$

$$(5)$$

Furthermore, Ehrlich (1973, p.526) identifies the optimal allocation of time between illegitimate and legitimate activities:

$$-\frac{w_i - w_l}{w_i - f_i - w_l} = \frac{pU'(X_a)}{(1-p)U'(X_b)}$$

$$(6)$$

This time allocation between illegitimate and legitimate activities depends upon the risk preference of the lone wolf. At this point, we resort to the 'wealth equivalents' deployed so often in defence economics and examine the lone wolf's time allocation under the assumption that engagement in terrorism yields a wealth equivalent, w_i. The lone wolf is enticed by the payoffs to terrorism when marginal expected return to illegitimate terrorist activities exceeds that in legitimate political activities. For a lone wolf who is risk seeking this is a sufficient but not a necessary condition. For risk averse or risk neutral lone wolves, this is both a sufficient and necessary condition (Ehrlich 1973, pp.527-528). If it is assumed that this condition is met[3], then the analysis can focus on the proportional allocation of time between the illegitimate and legitimate activities that characterises each of these types of lone wolves. We shall concentrate our attention on two 'types': the risk averse lone wolf and the risk seeking lone wolf.

A.1. The First 'Type' of Lone Wolf

The first 'type' of lone wolf is the risk averse lone wolf. The risk averse lone wolf will not spend as much time engaged in illegitimate activities as his risk seeking counterpart. He will certainly not be a 'specialist' terrorist and will be involved in other legitimate forms of political activism (or other types of activism if the objective is not a political one). In any given period, the risk averse lone wolf may engage in a series of illegitimate (terrorist) actions, providing that opportunities remain open to him and those opportunities for terrorism have an expected marginal return that exceeds that which characterises alternative legitimate activity. An alteration of the expected returns due to law enforcement action or enhanced security at potential targets may more readily deter the risk averse lone wolf from engaging in terrorism than it would his risk seeking counterpart. For these reasons, the risk averse lone wolf may space his terrorist activities well apart (in both time and geographic location) in order to remain within those 'pockets' that provide expected marginal returns in excess of those available to legitimate activities. The lone wolf will seek out these pockets up to the point that marginal benefits of the search equal the marginal costs[4]. Once the risk averse lone wolf attracts the attention of law enforcement

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[3] If the condition is not met, all empirically observed lone wolf terrorism must be undertaken by risk seeking lone wolves.
[4] This is a feature of the substantively rational economic agent.

and, perhaps, the popular press, he becomes especially elusive and may cease his terrorism for an indefinite period.

From the crimes or crime scenes—the nature of the terrorist attacks—we can determine whether the lone wolf is of the risk averse 'type'. Just like the investigative psychologists, however, this will probably only be possible after a series of two or three attacks (see above). A series of attacks that do not exhibit proximity in either time or geographic location is the first piece of evidence that may point towards the risk averse lone wolf. This is especially the case if, following the early attack (or attacks), law enforcement effort and security at similar targets has been visibly enhanced. It is possible that this enhancement has been reported on in the popular press. The risk averse lone wolf may be an individual that 'drifts' over relatively large distances seeking out those 'pockets' where expected marginal returns to terrorism exceed those to legitimate activity. He is unlikely to hold steady employment, though he may spend considerable time engaged in legitimate forms of political activism. Again, this activism may 'drift' to various locations and should exhibit a correlation with the terrorist activities.

At a higher level of specificity, the nature of the terrorist attacks may help to define the 'type' of risk aversion that the risk averse lone wolf exhibits which, in turn, may generate additional behavioural investigative advice. A risk averse lone wolf may exhibit decreasing, constant or increasing relative and absolute risk aversion[5]. As the lone wolf accumulates 'wealth' (measured as a wealth equivalent) by engagement in illegitimate terrorist activity and legitimate political activism over time, his allocation of time to these activities may change. If the risk averse lone wolf exhibits constant relative risk aversion, his allocation of time to terrorism relative to legitimate political activism will not change as his 'successes' accumulate. If the risk averse lone wolf exhibits increasing relative risk aversion, he will allocate less time to terrorism relative to legitimate political activism as his 'successes' accumulate. Economic analysis can provide guidance on the likely behaviour of a serial lone wolf. If the lone wolf is observed, after a series of successful terrorist activities, to curtail his activities or cease active terrorism altogether within a period, this is evidence of risk aversion and evidence that places the lone wolf within the 'risk averse type' (with the associated implications). If an assumption about relative risk aversion is made at the outset, law enforcement may be guided as to the expected behaviour of the lone wolf. If constant relative risk aversion is assumed, the risk averse lone wolf will continue to exhibit similar patterns following either successes or failures. If increasing relative risk aversion is assumed, the risk averse lone wolf will allocate less time to terrorism following a successful series of attacks. Once ensnared within the economic analytical framework, the lone wolf's actual behaviour reinforces the economic profile or, alternatively, the economic profile is augmented with assumptions that permit the economic analytical framework to generate predictions about the lone wolf's future activities.

A.2 The Second 'Type' of Lone Wolf

The second 'type' of lone wolf is the risk seeking lone wolf. Within the Ehrlich (1973) economic theoretical framework that underlies this part of the analysis, it is possible to say a number of things about the risk seeking lone wolf. For the risk seeking lone wolf to engage in terrorism, it is sufficient (but not necessary) for the

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[5] As wealth increases, relative risk aversion is reflected in the percentage of resources allocated to risky activities. Constant relative risk aversion implies the percentage remains the same. As wealth increases, absolute risk aversion is reflected in the absolute amount of resources allocated to risky activities.

expected marginal returns to terrorism to exceed those of legitimate activity. The risk seeking lone wolf will spend more time than his risk averse counterpart engaged in terrorism vis-à-vis legitimate political activity and might even specialise in terrorism. In any given period, the risk seeking lone wolf may engage in a series of terrorist activities. As law enforcement is intensified and security enhanced, the risk seeking lone wolf may intensify his terrorist activities. He is not as easily deterred as the risk averse lone wolf. For these reasons, the risk seeking lone wolf will focus his terrorism in a particular area or on particular types of targets. The terrorist activities are more likely to be in close proximity in time and geographic location (or by target type). He need not 'drift' far to look for opportunities where the expected marginal returns to terrorism exceed those of legitimate activities. Once the risk seeking lone wolf attracts the attention of law enforcement and the popular press, he may intensify his actions. It is a game to him. The risk is what drives him.

From the crimes or crime scenes—the nature of the terrorist attacks—we can determine whether the lone wolf is of the risk seeking 'type'. A series of attacks that is focussed within a particular time period, geographic location and target type points toward the risk seeking lone wolf. He is unlikely to be deterred and may be encouraged by law enforcement and popular press attention. Focussed attacks within the 'search area' are the work of the risk seeking lone wolf. He is bold but not reckless. His boldness cannot be relied upon to deliver the lone wolf to law enforcement. He will tease law enforcement by remaining close. He will not drift to other geographic locations in search of pockets where expected marginal returns to terrorism exceed the returns to legitimate activities. It is the risk that is his overwhelming desire and this risk is enhanced each time he engages in a successful terrorist activity and law enforcement moves closer and attention in the popular press becomes more intense. For all of this, the risk seeking lone wolf is elusive and difficult to locate. Unlike the risk averse lone wolf, the risk seeking lone wolf will probably not be engaged in other forms of political activism. He will not be an activist. He will not attend protests, demonstrations or rallies. He will not seek to actively promote a political message either online or through other forms of communication. He is close to the scene of his terrorist activities but until his next attack or his next attempt to taunt law enforcement, he will be invisible.

B. Substantive Rationality: A Risk-Return Approach

Within the investigative psychology literature, quantitative analysis of crimes, crime scenes and offender histories and behaviours has become an important part of the search for a framework that will permit sound inferences to be drawn about an offender from the characteristics of the crime scene. This type of approach is important if we wish to make more quantitative inferences about an offender. For example, the offender is likely to reside within a 40 mile radius of the crime scenes. Within an economic profile, risk and return play a critical role. Although we have been able to show that the economist may be able to say a number of useful things about the lone wolf, a standard economics of crime approach to the development of an offender profile will need to be supplemented if we are to first determine how risky the lone wolf's terrorist activities have been and, from that starting point, develop behavioural investigative advice that is more quantitative in nature. We might also be able to rely less completely on the idea of wealth equivalents. This involves attempting to extract behavioural investigative advice from Phillips' (2011) analytical framework. Together with a standard economics of crime approach, the two economic theoretical frameworks will deliver several pieces of behavioural investigative

advice that may prove to be useful additions to the advice that may be generated by the investigative psychologists.

Phillips' (2011) framework may be summarised as follows. It is a mean-variance theoretical framework where the lone wolf is assumed to optimise an expected utility function that is characterised by two arguments: risk and return. Because recent evidence suggests that lone wolves with an Islamic-Fundamentalist objective undertake terrorist activities with the objective to maximise fatalities and injuries, Phillips' (2011) starting point is the risk and return associated with this objective. This may be made more general by using the word 'optimise' instead of 'maximise'. The theoretical analysis remains the same but the lone wolf's optimal level of fatalities may be just a single individual victim. It should also be noted that, in principle, the risk-return theoretical framework may be applied to a broad range of different objectives: press attention, law enforcement reaction and so on. The expected return of a terrorist activity is measured by the mean fatalities that have historically characterised such activities and the risk is measured by the standard deviation of fatalities around the mean[6]. This provides a statistical framework to complement the economic theoretical framework that is somewhat analogous to the ways in which multivariate statistical analysis complements the approaches of the investigative psychologists. The basis for this statistical framework is the means and standard deviations of the various types of terrorist activities identified by RAND (and the Global Terrorism Database). Refinement of this statistical framework is, no doubt, an important task for future research.

Table 1   Statistical Summary 1967 to 2007 of Attack Methods

Attack Method	Variance	Standard Deviation	Average Annual Fatalities Per Incident
Armed Attack	1.261	1.122	1.296
Arson	0.565	0.7519	0.322
Assassination	0.15	0.3877	1.045
Hostage	135.79	11.653	3.62
Bombing	28.311	5.32	4.604
Hijacking	14.816	3.8491	1.566
Kidnapping	0.113	0.3355	0.393
Other	3.756	1.9379	0.473
Unconventional	576.281	24.005	3.883
Unknown	16.028	4.003	0.915

The two 'types' of lone wolves may be treated within economic theoretical framework described by Phillips (2011). Although Phillips (2011) appears to generate what might be considered to be behavioural investigative advice, he does not do so explicitly. Furthermore, Phillips (2011) concentrates on the risk averse lone wolf and does not cover the risk seeking lone wolf in detail. The lone wolf, within this framework, optimises an expected utility function on the basis of two arguments, mean and variance (or standard deviation):

$$U = (E_R, \sigma)$$

(7)

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[6] This framework may be applied to a crime such as serial murder where the offender may expect a number of victims (perhaps just one) from an attack but with a chance (a risk) that the actual number may be different from this expectation. The metrics are mean and standard deviation. The relevant data may be obtained from law enforcement archives and may include number of attempted attacks, number of victims, number of survivors.

The exact specification of the utility function usually depends upon the nature of the analysis being undertaken. A quadratic utility function guarantees that any preference ordering undertaken on the basis of the mean-variance criterion will be consistent with the NM axioms of expected utility. Despite some problems with the quadratic utility function, it will approximate a wide range of alternative utility functions and appears to perform well in empirical tests (see Elton *et al.* 2003, p.232; Kroll, Levy and Markowitz 1984; Levy and Markowitz 1979; Meyer 1987). Given this, the starting point is a lone wolf who optimises a quadratic expected utility function. Once the results are extracted from this mean-variance theoretical framework, we move on to alternative specifications for the utility function. Again, the economic profile is concerned with the risk-averse-risk-seeking dichotomy.

B.1 The Risk Averse 'Type' of Lone Wolf: Mean-Variance Analysis

Phillips (2009; 2011) demonstrates some of the calculations that are possible within a mean-variance expected utility framework. In this section, we shall take a more theoretical or qualitative approach and concentrate on the behavioural investigative advice that may be generated from the framework (which, in principle, can be supported by computable quantitative results). A risk averse lone wolf optimises an expected utility function of the following specification (see Elton *et al.* 2003, p.220) where F, for 'fatalities', has been substituted for W (wealth or wealth equivalent):

$$E[U(F)] = E(F) - b\{\sigma_F^2 + [E(F)]^2\}$$

(8)

This utility function captures the idea that a lone wolf may expect or be aiming for a particular number of victims (perhaps just one victim). The standard deviation of the fatalities associated with the chosen attack method captures the idea that this expectation may not be met. There may be more or less victims than expected. For economic profiling, the investigative economist would determine the risk-return characteristics of the crime or illegitimate terrorist activity and from this analysis place the lone wolf into a risk averse 'type'. This can be accomplished very simply by elimination. If, after a series of terrorist activities, the lone wolf has exhibited a tendency to avoid the riskiest attack types, the lone wolf is unlikely to be risk seeking and more likely to be risk averse. Here, a prediction from economic theory guides the classification of the lone wolf but just like investigative psychology, it can only do so on the basis of information about the crime or terrorist activity. Having established this aspect of the profile, a further step can be taken. If the risk averse lone wolf is characterised by a quadratic utility function—remembering that such a utility will approximate closely a broad class of other utility functions—he will be characterised by increasing relative risk aversion.

From the crimes or crime scenes—the nature of the terrorist attacks—we can determine whether the lone wolf is of the risk averse 'type'. The risk averse lone wolf will not be observed to engage in the riskiest activity or combination of activities (hostage taking and unconventional attacks). Although a risk averse lone wolf will take tremendous risk if it is appropriately rewarded, he will not usually be found to allocate all of his time to the riskiest activities. After a series of successful terrorist activities, the risk averse lone wolf who exhibits increasing relative risk aversion will reduce the amount of time and other resources that he allocates to

illegitimate terrorist activities. He may also become satiated after a small number of successful attacks. He is easily satiated and success may lead to his indefinite withdrawal from terrorist activity. Law enforcement has a small window of time to ensnare the risk averse lone wolf. He is prone to drift in search of pockets where the returns to terrorism exceed the returns to legitimate activity. In this way, the risk averse lone wolf is elusive. He will not taunt law enforcement. He will be found engaged in legitimate political activism at considerable distance from the location of his attacks. After a series of successes he may not engage in terrorism for a considerable time, if at all.

B.2 The Risk Seeking 'Type' of Lone Wolf: Mean-Variance Analysis

Within the mean-variance framework, the quadratic utility function—Equation (8)—for a risk seeking lone wolf will be characterised by a negative *b* and a positive second derivative. The risk associated with the targets *adds* to the expected utility of the risk seeking lone wolf. The risk seeking lone wolf will be found inhabiting the highest risk terrorist activities, the point of maximum risk and expected return (see Tobin 1958, p.79). If this risk is measured by the historical standard deviation of the fatalities associated with terrorist attack methods, then the highest risk terrorist activities are hostage taking and unconventional attacks. In turn, it is the observation of these types of crimes or terrorist activities that point towards the risk seeking lone wolf. Each increment of risk increases the risk seeking lone wolf's utility. He obtains satisfaction from taking risk. He desires it. He will not be interested in legitimate political activity. He will not be found engaged in demonstrations, rallies or other forms of activism. He will not drift looking for targets that promise returns that are commensurate with their risks. It is the riskiest of targets that entice him. He will taunt law enforcement. It is the terrorism that will define him. Apart from terrorist activity and his taunts, he is quiet. He will be found close.

B.3 The Risk Averse 'Type' of Lone Wolf: Logarithmic Utility

Different specifications of utility will provide additional insights. In considering an individual's decisions under risk and uncertainty, the mean-variance framework is an alternative to a full expected utility analysis where, theoretically, each possible payoff to a terrorist activity is assigned a probability and then a choice is made depending on the expected utility (not expected payoff) of the activity. When a full expected utility analysis is undertaken, the logarithmic utility function is a popular choice of economic analysts. The logarithmic utility function displays certain properties, especially constant relative risk aversion, that may provide additional elements of an economic profile for a risk averse lone wolf. If the payoffs to terrorist activities are uncorrelated over time, the horizon of 'multiplicative activities' will not affect the lone wolf's decision to engage in terrorism (see Elton et al. 2003, p.221). This behaviour comes with an additional insight. The risk averse lone wolf with logarithmic utility has very large aversion to losses (see Elton et al. 2003, p.221)[7]. Law enforcement attention that increases the chances of failure considerably will repulse the risk averse lone wolf (with logarithmic utility). He will not risk another terrorist action where he believes the attention of law enforcement is focussed. He will drift away. He will watch from a distance. He will resume his terrorism where he feels safer.

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[7] This has caused concern among financial economists. However, like some of the properties of the quadratic utility function, this concern need not necessarily spread to other types of economists.

IV. THEODORE KACZYNSKI AND FRANZ FUCHS: TWO LONE WOLVES

Economic science can provide behavioural investigative advice. How valuable the advice is will be a question for future research. In order to provide some preliminary starting points for this broader research program, it will be useful to examine two well-known lone wolves in order to highlight aspects of their terrorist activity and other behaviour that economists may use to construct an economic profile. Two prominent lone wolves are Theodore (Ted) Kaczynski and Franz Fuchs[8]. Kaczynski is an American. Fuchs is an Austrian. Both lone wolves engaged in bombing campaigns over a number of years. Kaczynski was active in terrorism for twenty years. Fuchs was active for four years. Kaczynski mailed sixteen packages and letter bombs resulting in three deaths and 23 injuries. Fuchs engaged in several 'sprees' of attacks in addition to two individual or isolated attacks involving more than twenty bombs that left four people dead and fifteen injured. Because these two lone wolves were engaged in a series of attacks that could be identified as the actions of a single individual, their behaviour falls into a type of illegitimate activity that is the subject of profiling by the investigative psychologists. Both lone wolves were profiled during the ensuing man-hunts. The nature of these individuals' terrorist activities may also be analysed from the point of view of an investigative economist.

In the previous section, we have concentrated on the construction of a risk-averse-risk-seeking dichotomy that may be used in a manner analogous to the organised-disorganised dichotomy that is popular in investigative psychology to generate a profile for an offender. Risk preference is a factor that pervades the economic theoretical models of crime and terrorism. It will be an essential component of any economic profile though future research and development may reduce the prominence that it has been accorded in our prototype economic profile. Within the risk-averse-risk-seeking dichotomy and the economic theoretical framework that encases it, inferences may be drawn about a lone wolf terrorist from factors that describe the nature of the terrorist activities of the lone wolf. In the context of two lone wolves, Theodore Kaczynski and Franz Fuchs, the risk-averse-risk-seeking dichotomy is discussed in order to determine whether aspects of the terrorist activities of these lone wolves could have been used to assign either individual to one of our categories and, based on such a classification, whether the economic profile would have generated behavioural investigative advice that was, at least, not completely misleading. Given the current state of affairs within the investigative psychology discipline, such a conclusion for economic profiling would be an encouraging very small first step.

Among the attack methods, bombing does not have the highest standard deviation. It is not the riskiest attack. It is, however, much more risky than many of the other types of attack methods. Both Kaczynski and Fuchs engaged in bombing. However, both lone wolves utilised a mixture of 'letter bombs' and hand delivered or planted devices. Letter bombing reduces the risk of being found at or linked to the scene may reduce the variance of actual outcomes from that which was expected by means of being directed to a particular individual or target. Both Fuchs and Kaczynski are highly intelligent and certainly capable of assessing the risk-return tradeoffs associated with their activities. Letter bombing might be considered to be a way to reduce the risk associated with bombing. It is also a way of 'drifting' to find pockets where the returns to terrorism exceed those of legitimate political activity, though the letter-bombing lone wolf need not actually move to a different

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[8] Details obtained from Instituut voor Veiligheids en Crisismanagement (2007).

location. If this is true, both lone wolves are starting to look risk averse. However, Fuchs and Kaczynski differ on one important point. Fuchs' single deadliest attack was the result of a bomb he had planted in a public place. It was not targeted at a particular individual or organisation and he spent at least some time at the scene in order to set up the device. Fuchs is starting to appear less risk averse and more risk seeking.

Like our risk seeking lone wolf, Fuchs did not have a significant program of legitimate political activity. Fuchs did not withdraw from terrorism or drift away, even after his deadliest attacks. His campaign was continuous, as if fuelled by the increasing attention his terrorist actions received. He was enticed by the risk. He taunted law enforcement. He sent them long letters. He embellished his activities by inventing a terrorist organisation (*Bajuwarische Befreiungsarmee*) of which he claimed to be a member and a messenger. He was close. Kaczynski is different. Like our risk averse lone wolf, Kaczynski produced a manifesto and actively pursued the legitimate task of conveying his ideas in writing. At one point, he declared that he would cease his terrorism if his manifesto were published. Kaczynski did not escalate his activities as he attracted law enforcement and press attention. He did not taunt them. After one deadly attack, Kaczynski ceased to engage in terrorist actions for a number of years. He faded away and was inactive for long periods. He was found far from the scene of his attacks in a remote location. One is close. One is far away. Both are exactly where the investigative economist expected.

The investigative economist can infer a number of things about a lone wolf offender from the nature of his attacks and his other observable behaviours. The value that this may have for law enforcement investigations can only be ascertained by much future research. When individuals are making motivated choices aimed at achieving some objective, economic science has important insights to provide. This is all the more the case when intelligent individuals engage in illegitimate activities that by their very nature involve the assessment of risk and return. As a first step, the risk and return that characterises a terrorist activity is the most straightforward foundation on which to build an economic approach to profiling. Other behaviours are linked to the lone wolf's risk preferences. Lone wolves are characterised by certain features of their involvement in terrorism and political activity. They either do or do not drift across different locations. They either do or do not cease to engage in terrorism after successes or failures. They either do or do not taunt law enforcement. Placing these behaviours within an economic theoretical framework and successfully using that framework to draw inferences about the lone wolf that may be relevant to law enforcement investigations is the next logical extension of the longstanding program within economic science of explaining the behaviour of criminals and terrorists.

V. CONCLUSIONS AND FUTURE RESEARCH

Offender profiling involves making inferences about an offender from aspects of the crime or crime scene. The theoretical frameworks that permit these inferences to be made have been studied within the emerging discipline of investigative psychology. There is no reason, in principle, that economic science cannot contribute to this debate and, in particular, provide an economic approach to developing an offender profile. In fact, this is the logical extension of the now considerable literature dealing with the economics of crime and terrorism. Rather

than focus on how theoretical economic agents may react to incentives, however, an economic approach to offender profiling consists of working with real-world criminal evidence and the logic of the economic theoretical frameworks to generate behavioural investigative advice[9]. In this paper, we have proposed a very preliminary economic typology based on risk preference: a risk-averse-risk-seeking dichotomy. Given certain aspects of the risk-return tradeoffs that characterise particular types of terrorist attacks and terrorism vis-à-vis legitimate political activism, an expected utility theoretical framework constructed on the solid foundations laid by Becker (1968) and Ehrlich (1973) does provide a theoretical structure that permits the investigative economist to move logically from aspects concerning the nature of the individual's crimes or terrorism to conclusions that may be relevant to those in law enforcement who seek to apprehend a perpetrator.

In this paper, we have concentrated on lone wolf terrorism. This is a particular form of criminal activity and one that is very suitable to this type of analysis. Serial lone wolf terrorists make choices that are designed to achieve an objective. What we have done is to highlight the possibility that the manifestation of these choices in actual terrorist activity or legitimate political activism may permit the classification of the unknown perpetrator into a particular category. Once classified, the logic inherent in the choice theoretical structure may generate insights that go beyond the purely theoretical and, when applied to particular cases, may generate behavioural investigative advice. We have applied a substantive rationality approach throughout. However, Simon's (1978) procedural rationality approach has much to recommend it. Of particular importance is Simon's (1978) observation that how the individual makes a decision is as important as what decision is made. Computation is a scarce resource and individuals may need to weigh up the costs of further searching and of further computation against the necessity of making a decision. Since investigative psychology has proven itself to be open to new techniques and new approaches, one particularly interesting avenue for future research is the investigation of the relevance and utility of cognitive simulation in exploring the procedural rationality of offenders (see Simon 1978, p.502). This is in addition, of course, to the further investigation of the contribution that can be made by economic science to the generation of behavioural investigative advice.

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[9] An analogy is the way in which a chess player may work with a computer to choose the best course of action.

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