

# Depression through the Lens of Economics: A Research Agenda\*

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## Abstract

Major depressive disorder (MDD) is one of the most prevalent mental illnesses worldwide. Existing evidence suggests that it has both economic causes and consequences, such as unemployment. However, depression has not received significant attention in the economics literature, and existing work is almost entirely empirical. We see great potential for traditional, theoretical economic analysis to both develop new insights about depression, and to form new connections to other areas of economics. In this paper, we begin with an overview of the canonical symptoms of depression, identifying a set of key facts that lend themselves well to economic analysis. We illustrate these facts with descriptive analysis of data from Indonesia. We then discuss what we see as fruitful avenues for new theoretical work, building on those facts.

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## 1 Introduction

Major depressive disorder (MDD; henceforth simply “depression”) is one of the leading causes of disease burden worldwide, second only to lower back pain in terms of years lost to disability (Vos et al. 2012). The cross-sectional prevalence is an estimated four to five percent of the global population at a given time (Vos et al. 2012; Steel et al. 2014), and lifetime prevalence averages 13 percent across a sample of 18 countries (Bromet et al. 2011; see Kessler and Bromet 2013 for a review). The economic costs of depression from lost productivity have been estimated at around €76bn in Europe (Sobocki et al. 2006) and \$31bn in the United States (Stewart et al. 2003).

Given this high prevalence, the significant economic cost, and economists’ interest in other psychiatric conditions such as substance abuse (Becker and Murphy 1988), it is perhaps surprising that depression has not received greater attention in the economics literature. In this paper we seek to make three contributions. First, we describe the canonical symptoms of depression in the language of economics, and discuss what these symptoms imply for economic outcomes. Second, we present descriptive evidence illustrating the relationships between depression and important economic variables. Third, we discuss two main approaches how economic theory might model depression. Together, our hope is to signpost ways economics, and in particular economic theory, can take towards understanding depression.

Our first exercise is to describe depression in the language of economics. In doing so, we follow the classification of the symptoms of depression provided by Aaron Beck, one of the foremost theorists on depression in psychiatry, as well as the diagnostic criteria laid out in the standard diagnosis manual, the DSM-5. Beck grouped the symptoms of depression broadly into four categories, which he termed cognitive, motivational, emotional, and somatic, respectively (Beck 1967). We argue that many symptoms can be thought of as capturing distorted beliefs about the returns to effort, informed by shocks that the decision-maker experiences; or distortions in preferences, e.g. by shocks that affect marginal utility. Specifically, many depressed patients exhibit pessimistic beliefs about the future, themselves, and the world (this classic group of symptoms is known as Beck’s “cognitive triad”), suggesting a change in beliefs. In addition, they are frequently unable to derive pleasure from otherwise enjoyable activities, suggesting a change in preferences. These features of depression are reflected in economic outcomes: depressed individuals reduce labor supply,

consumption, and investment, increase temptation good spending, and have altered eating and sleeping patterns.

Our second contribution is to illustrate the economic characteristics of depression using cross-sectional data from the Indonesia Family Life Survey (IFLS-5), which surveyed 50,148 individuals in 16,204 households. We show that depressed individuals indeed have lower labor supply and consumption than non-depressed individuals; their educational investment is lower, they spend more money on temptation goods, and they have altered sleeping patterns. This correlational analysis fulfills two purposes. First, the economic correlates of depression provide a first plausibility check on our description of depression in terms of economic primitives described above. Second, the analysis, together with existing literature, provides a list of stylized facts to be accounted for by theory.

Our final contribution is to propose a research agenda for modeling depression using standard economic analysis. Specifically, we discuss two possible modeling approaches. The first is to model depression with distorted beliefs about the returns to effort as a result of a shock, such as a stressful negative life event. We suggest that such a shock to beliefs can generate several of the sets of features of depression described above: pessimism about the future; reduction in labor supply, income, and consumption; and changes in sleeping and eating patterns. The second approach is based on changes to preferences: if shocks lead to distortions of marginal utility, or beliefs about marginal utility, this in turn could generate the emotional symptoms of depression described above, especially the inability to derive pleasure from everyday activities.

We do not presume to have all the answers. The tradition of applied economic research, exemplified by the work of Becker and Murphy (1988) on addiction, is to reduce complex environments to a small number of mechanisms – in our case, shocks to beliefs and preferences. We do not claim that simple theories will explain every nuance of the causes, symptoms or consequences of depression. We nevertheless find it a valuable exercise to identify key economic mechanisms and behaviors among the psychological evidence. We think of this paper as a first step toward a richer economic approach to thinking about depression, both theoretically and empirically.

The remainder of the paper is organized as follows. Section 2 attempts to describe the symptoms of depression in the language of economics. Section 3 presents empirical data illustrating the relationships predicted by the model. Section 4 discusses potential avenues for a description of depression in terms of economic theory.

Section 5 concludes.

## 2 Describing depression in the language of economics

In this section, we make an attempt to describe the symptoms of depression in the language of economics. The goal of this exercise is to see to what extent we can distill the complex symptomatology of depression down to economic primitives, in particular, beliefs and preferences. We mainly use the comprehensive list of symptoms provided by Beck (1967), and in the entire following section we paraphrase heavily from his exposition. Beck's list of symptoms was originally compiled by generating a list of candidate symptoms from textbooks and monographs; conducting a pilot test comparing the presence of the individual symptoms in 50 depressed patients and 30 non-depressed patients; constructing an inventory consisting of items relevant to depression and pre-testing it on 100 patients; and finally, presenting the revised inventory to 966 psychiatric patients, of which 224 had no depression, and 297, 360, and 85 patients had mild, moderate, and severe depression, respectively.<sup>1</sup>

The other obvious candidate list of depression symptoms are the diagnosis criteria presented in standard diagnostic manuals, such as the DSM-5 in the United States. However, these symptoms are a subset of those described by Beck; we therefore focus on his more comprehensive list, and mention in our discussion which of these symptoms are also used as diagnosis criteria. In addition, the DSM-5 diagnosis criteria are listed in the Appendix.

### 2.1 “Cognitive” symptoms

The *cognitive* symptoms of depression describe a set of negative beliefs and attitudes towards oneself and the environment; distorted “notions of causality”, in which patients blame themselves for problems; and indecisiveness. Specifically, Beck describes five such symptoms: first, depressed individuals have *low self-evaluation* or self-esteem; i.e. they feel that they are inadequate and not performing well, including in their financial lives, e.g. feeling that they are impoverished. Second, they have *negative expectations* about the future; “a pattern of expecting the worst and rejecting the possibility of any improvement”. Third, patients engage in *self-blame*

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<sup>1</sup> Beck leaves open the question how these patients were diagnosed as depressed, and how severity was assessed; the standard tool is the clinical interview which tests for the presence of depression symptoms, so it is likely that there is a degree of circularity in the list of symptoms.

*and self-criticism* because of their “egocentric notions of causality” cause them to “ascribe adverse occurrences to some deficiency in themselves”.<sup>2</sup> Fourth, patients exhibit *indecisiveness*, i.e. are unable to make even simple decisions. The reason for this inability is that “[d]epressed patients anticipate making the wrong decision: whenever they consider one of various possibilities they tend to regard it as wrong and think they will regret making that choice.” Finally, patients suffer from *distortion of body image*, thinking that they are unattractive. For instance, a man might “worr[y] incessantly about the beginnings of hair loss, convinced that women find him unattractive.”

These cognitive symptoms are closely congruous with idea that depressed patients have pessimistic beliefs about their returns to effort. Specifically, a patient with negative expectations about the future and egocentric notions of causality would believe precisely that her actions led to undesirable outcomes. This, in turn, would generate self-blame and self-criticism and result in low self-evaluation. Such beliefs could lead to indecisiveness because patients are worried about their actions leading to bad outcomes. Finally, the distortion of body image, e.g. the belief that one is unattractive, could be conceived of as a pessimistic belief about the returns to investment in one’s own physical appearance.

## 2.2 “Motivational” symptoms

The motivational symptoms of depression are mainly characterized by withdrawal from activities, escapist tendencies and avoidance of responsibility, the assumption of a child-like rather than an adult’s role, and a focus on “immediate but transient gratification instead of delayed but prolonged gratifications”. Specifically, Beck describes four symptoms in this category: First, patients have *paralysis of the will*, i.e. they “have a major problem in mobilizing themselves to perform even the most elemental and vital tasks”. Beck identifies as the reason for this paralysis that “although they can define for themselves what they should do, they do not experience any internal stimulus to do it”. Second, patients show *avoidance, escapist, and withdrawal wishes*: they want to shirk from their duties and want to withdraw into other activities. Third, patients exhibit increased *dependency* on others, in the sense that they want others to perform tasks for them. Finally, depressed patients often have

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<sup>2</sup>Evidence on the predictors of depression onset suggests that shocks in domains where individuals believe outcomes are under their control are particularly predictive of depression (Kendler, Karkowski, and Prescott 1999).

*suicidal wishes.*

Most of these motivational symptoms can be understood as direct consequences of the core cognitive symptom described above, i.e. pessimistic beliefs about oneself. In particular, when an individual believes that their actions lead to negative outcomes, she may naturally want others to perform tasks for them instead. Relatedly, if she believes that her own efforts will not amount to anything, so may choose not to undertake them in the first place, which presents itself as paralysis of the will to the observer. Similar reasoning could be implicated in avoidance, escapist, and withdrawal wishes, i.e. individuals with negative beliefs about the consequences of her actions may cause her to avoid having to perform these actions in the first place and instead withdraw from life. Finally, suicidal wishes may be an extreme manifestation of the escapist tendencies described above; for instance, they could occur when people believe that efforts generate *negative* returns.

### 2.3 “Emotional” symptoms

The emotional symptoms of depression mainly consist of dysphoria, i.e. low mood and an inability to feel pleasure, and related symptoms. Specifically, depressed patients experience *dejected mood*, i.e. they feel “sad”, “hopeless”, or “miserable”. They also exhibit a *reduction in gratification*, in the sense that they are unable to derive pleasure from activities they usually enjoy. This inability extends to both professional and personal contexts, and includes basic activities such as eating and sex. Third, patients experience *negative feelings toward themselves*, blaming themselves for mistakes and believing that they “can’t do anything right”. Fourth, the inability to derive pleasure from previously enjoyable activities is accompanied by a *loss of emotional attachment*, i.e. a “decline in interest in particular activities or in affection or concern for other persons,” including one’s job, family, and friends. Fourth, depressed patients show a *loss of the mirth response*, i.e. their sense of humor: they still understand the point of jokes, but do not find them funny. Finally, they frequently experience *crying spells*.

Dejected mood and crying spells may be thought of as consequences of the reduction in income and overall experienced utility that results from the behaviors above. Similarly, negative feelings toward oneself are a natural consequence of this effect to the extent one assumes blame (which depressed individuals often do; recall the “egocentric notions of causality” described above).

In contrast, loss of emotional attachment, reduction in gratification, and loss of

mirth response are, in our view, best understood as consequences of as *low marginal utility of consumption of experiences, relationships, and humor*. This subgroup of emotional symptoms is the leading set of symptoms which is difficult to conceptualize as resulting from pessimistic beliefs. Put differently, these symptoms appear to be about *preferences* rather than *beliefs*.

## 2.4 Delusions

Depressed people frequently suffer from delusions of various types. Beck describes five main categories. First, in *delusions of worthlessness*, patients believe that they are such a burden to others that “it would be better if I had not been born”. Second, in *delusions of crime and punishment*, patients believe that they have committed crimes for which they “deserve to be punished”. In extreme cases, patients believe that they are the devil. In *nihilistic delusions*, patients believe that the world is “empty”, all other people have died, or they themselves have died. Other patients believe that some of their organs are missing. Relatedly, *somatic delusions* cause patients to believe their bodies are decaying or that they have fatal illnesses. Finally, in *delusions of poverty*, patients believe that they are impoverished. Beck writes: “Delusions of poverty seem to be an outgrowth of the overconcern with finances manifested by depressed patients. A wealthy patient may complain bitterly, ’All my money is gone. What will I live on? Who will buy food for my children?’”

Delusions are more difficult to fit into a framework of beliefs and preferences; for instance, the belief that one’s body is decaying or that organs are missing has no natural connection to economic variables. Nevertheless, several of the delusions described above are plausibly extreme consequences of pessimistic beliefs. Most prominently, the belief that one is or will be impoverished may be a natural consequence of such beliefs. Similarly, the belief that one is worthless, responsible for bad outcomes, and deserves punishment may be a consequence of the same type of belief.

## 2.5 Somatic symptoms

Not covered in Beck’s description of the symptoms of depression, but contained in the DSM-5 diagnosis criteria, are two important somatic symptoms. Specifically, depressed individuals often display either hypersomnia or insomnia, i.e. excessive sleeping or an inability to sleep. Secondly, they frequently suffer from either a lack

of appetite, or overeating. Such non-monotonicities provide interesting restrictions on the form economic theories can take. Theories in which people face conflicting internal and external motives (for example, they need to sleep eight hours to be productive, but their “natural tendency” is to sleep more or less) may be able to fit these facts. In these cases, distortions to beliefs or preferences might alter the trade-offs between motives: a negative shock to beliefs about the returns to labor provision, for instance, would shift the optimum level of food and sleep from the “productive” optimum to the “consumption” optimum. As a consequence, the observed levels of eating and sleeping may either rise or fall, depending on whether the consumption optima lie below or above the production optima. Of course, preference change could be an alternative, competing explanation for these symptoms.

## 2.6 Hallucinations

Finally, depressed patients frequently report hallucinations. In the most common case, these consist of patients hearing voices “that condemn the patient”. Such hallucinations can possibly be understood as an extreme manifestation of pessimism about oneself.

## 3 Stylized facts

In this section, we briefly present a number of empirical stylized facts about depression that our model attempts to predict. Owing to the dearth of good causal evidence on the consequences of depression, we mainly do this by presenting correlations between depression and other variables. We rely on the 2014–2015 wave of the Indonesia Family Life Survey (IFLS-5), which surveyed 50,148 individuals in 16,204 households. Depression is measured using the Center for Epidemiologic Studies Depression Scale (CESD), a widely used and validated self-report instrument for measuring depression. We emphasize that the usual disclaimers about correlational evidence apply, and that future work should tease out the direction and strength of causality in the relationships we describe below.

We begin by noting that in our data, economic shocks are associated with depression. We present in Table 1 the relationship between CESD scores and indicator variables for whether the household had a business that closed in the past 18 months, experienced natural disaster or civic strife, or experienced any economic disruption. We find moderately sized and highly significant associations between depression

scores and all three variables, with the largest point estimate, a 0.19 standard deviations (SD) difference in depression scores, for households with a business that recently shut down. Thus, depression is associated with economic shocks. In addition, quasi-experimental evidence suggests that economic shocks in the form of floods, droughts, or job loss lead to increases in mental disorders, including depression (Amstadter et al. 2009; Goenjian et al. 2001; Mendolia 2009; see Rataj, Kunzweiler, and Garthus-Niebel 2016 for a review). Conversely, randomized controlled trials and natural experiments have shown that poverty alleviation interventions such as unconditional cash transfers lead to reductions in depression (Haushofer and Shapiro 2016). More broadly, programs like health insurance, pensions, microfinance, and access to water lead to improvements in overall mental health and psychological well-being (Devoto et al. 2012; Ssewamala, Han, and Neilands 2009; Ssewamala et al. 2012; Finkelstein et al. 2012; Rosero and Oosterbeek 2011; Tseng and Petrie 2012).

We next ask how depression relates to economic choice variables such as labor supply and expenditure decisions. Panels A–D of Figure I illustrate relevant relationships in the Indonesia data using local linear regressions. Pessimistic beliefs about returns would suggest that labor supply should correlate negatively with depression, by weakening the incentives to supply labor. Indeed, we find a strong negative overall relationship between depression and the number of hours the individual works in a typical week. The relationship is not completely monotonic at low levels of labor supply: below about 22 working hours per week, it has a shallow positive association with depression scores. However, over most of the distribution, the relationship is strongly negative.

Next we consider investment and temptation goods, whose consumption might be affected by belief or preference change. In the Indonesia data, we find negative relationships between depression and total expenditure, and spending on education; conversely, we find a positive relationship with spending on tobacco.<sup>3</sup> This finding is supported by correlations between depression and changes in tobacco consumption within individuals (Taylor et al. 2014). The causal relationship between depression and tobacco use has been the subject of intense debate in the medical literature, with authors arguing both that smoking precedes and precipitates depression (Munafò et al. 2008; Boden, Fergusson, and Horwood 2010), and that depression increases

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<sup>3</sup>Spending on another important temptation good, alcohol, is not shown because Indonesia is a Muslim country and therefore the vast majority of our sample do not consume any alcohol.

smoking (Windle and Windle 2001); however, we are not aware of rigorously causally identified studies of the effect of changes in depression status on smoking.

Finally, we highlighted a non-monotonic relationship between depression and food intake, and between depression and sleep. The diagnosis criteria suggest that depressed individuals suffer from either increased or decreased appetite, and increased or decreased sleep. In our data, we proxy increased or decreased food intake with body mass index (BMI, measured in  $kg/m^2$ ), and sleep with the number of hours the individual slept in the preceding night. Panels E–F of Figure I show that indeed we find non-monotonic relationships between these variables and depression scores: high depression scores are associated with both very short and very long sleep duration, and with both high and low BMI. The upward-sloping relationship between BMI and depression at the upper end of the BMI distribution is not very pronounced, possibly because in this sample, the BMI distribution does not have much support at high levels of BMI.

On the whole, we find good correlational support for the associations between depression and economic variables. We stress again that these relationships are not causal, and can therefore only be suggestive. In particular, it is likely that in several cases, causality runs from the other variables to depression; e.g. being unable to work, being overweight or underweight, or having a sleep disorder can plausibly lead to depression. Future work could investigate the causal effect from depression to these variables.

## 4 Avenues for economic theory

The goal of this section is to suggest directions for new theoretical work on depression. The symptoms outlined above suggest a core set of mechanisms that we believe are amenable to economic modeling.

We see three main benefits of using economic theory to study depression. First and foremost, depression and mental health more broadly raise first-order welfare concerns, and translating the core of the symptomatology and evidence for driving mechanisms into economic theory can give economists a richer language and terminology with which to discuss these issues. Second, formal models of depression would allow it to be incorporated into other applied analyses, for instance into macroeconomic modeling or policy analysis. Third, theoretical analysis may deliver new insights for understanding mechanisms underlying depression, predicting

new behaviors caused by depression and even guiding potential new approaches to treatment.

In the following, we discuss two main approaches for capturing the symptoms of depression in economic models: beliefs-based and preference-based models. As mentioned above and further discussed below, a number of features of depression lend themselves to a description in terms of distorted beliefs, while others (in particular, emotional symptoms) are more readily captured by changes in preferences. We do not view these mechanisms as mutually exclusive.

## 4.1 Beliefs

In the following, we outline a simple model of belief-driven depression (de Quidt and Haushofer 2017). The core mechanism at the heart of the model is that external shocks can lead people to hold negative beliefs about themselves. This mechanism is analogous to the first pillar of Beck’s cognitive triad, and turns out to predict several of the stylized facts described above. Consider a decision-maker maximizing utility from consumption, and makes productive decisions to generate income by supplying labor. In each period, the decision-maker chooses labor effort, then observes her income realization. Based on this, she forms a (Bayesian) belief about his returns to effort, which feeds into choices next period.

This very simple model can fit a number of the key facts. It generates pessimistic beliefs following negative shocks, which lead to withdrawal of labor effort. In addition, inputs into production which are complementary to beliefs, such as food and sleep, are not optimally chosen: because these variables are both consumption and inputs into production, decreases in one’s beliefs about the returns to effort will lead to changes in food and sleep away from the production-optimal allocations towards the consumption-optimal allocations, which will decrease output. Income and consumption are also therefore lower among the depressed, and food and sleep patterns are altered. Investment, e.g. in education, would be reduced for similar reasons, and spending on temptation goods, which can be thought of as negative investment, would increase. Thus, a simple model of pessimistic beliefs about the returns to effort has the potential to capture many of the stylized facts.

#### 4.1.1 Role of non-Bayesian updating

A natural starting point for any modeling effort is that agents learn about their returns to effort via Bayesian updating, and in a sense become depressed “rationally.” Modeling belief formation as Bayesian has many attractive theoretical properties – it is familiar to economists, captures the key intuition needed (essentially, that beliefs become more negative following a shock) and is tractable and parsimonious.

But Bayesian belief formation also raises questions. Is it reasonable to think of depression as “rational”? We suspect many would find this at least highly controversial. Moreover, is it calibrationally realistic? Individuals have a whole lifetime to learn about their returns to effort, so for a single unemployment shock to be sufficient to convince them their returns are much lower than they previously thought may not be quantitatively consistent with Bayesian updating.<sup>4</sup>

Promising directions for future work could involve use of models of non-Bayesian updating. A number of papers study models of “motivated cognition” in which decision-makers distort or selectively remember information to arrive at biased beliefs.<sup>5</sup> A key empirical finding is overconfidence, potentially arrived at by asymmetric updating after positive and negative information (see e.g. Eil and Rao (2011) and Möbius et al. (2011)). But there is some evidence of “depressive realism,” that depressed people hold more accurate beliefs about the world, thus appearing *relatively* pessimistic (Alloy and Abramson 1979). As for calibration issues, one possibility is that depressed people tend to focus “too much” on recent negative news, overweighting it relative to the past. Underweighting of prior information is related to as the “base-rate fallacy” (Bar-Hillel 1980).

In sum, a potential force driving the onset of depression is changes to the belief updating process, to become more selectively negative, or to focus too much on recent shocks and events.

#### 4.1.2 Poverty traps

The flip-side of becoming overly pessimistic in response to recent bad news is a tendency for spells of depression to persist and recur. In the model sketched above, this

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<sup>4</sup>A related calibration point: in discussion at the AEA meetings, Justin Wolfers pointed out that while depressed people in the United States have somewhat lower incomes than non-depressed people, the drop in life satisfaction associated with depression is considerably larger than would be expected from income alone.

<sup>5</sup>See for example the review in Bénabou and Tirole (2016).

could lead to a “depression poverty trap,” in which pessimistic beliefs cause people to withdraw effort and stop learning about returns.<sup>6</sup> An important mechanism in models in which learning depends on choice is the extent to which the decision-maker is sophisticated about future learning. For example, a depressed person who is aware that her beliefs might be overly pessimistic might continue to take exploratory actions so as to ascertain whether that is the case. The extent to which depressed people are sophisticated in this manner is, to our knowledge, unknown.

## 4.2 Preferences

### 4.2.1 Shocks to marginal utility

The experience of dysphoria as discussed under “emotional” symptoms most naturally lends itself to a preference driven explanation. Something about the preferences of depressed people changes to reduce the satisfaction from once-pleasurable activities. One possible source for this effect is that pessimistic expectations of the future diminish the pleasure of consumption today, perhaps even as a form of protection against future disappointment. Such behavior might be well captured in a reference-dependent model, relating to e.g. Kőszegi and Rabin (2006), Kőszegi and Rabin (2009).

A simple way to capture dysphoria is to distort marginal utilities. For example, depression could be characterized as a decrease in the marginal utility of non-food consumption. Such a lower marginal utility of non-food consumption reduces the incentive to earn income, and also distorts the trade-off between consumption and production motives in food and sleep. It literally captures the notion that consumption delivers “less utility” than before. While such a mechanism is less congruent with symptoms related to a negative view of the self, it aligns well with pessimistic beliefs about the future if the individual expects that future consumption will also be less satisfying and pleasurable.

### 4.2.2 Beliefs about marginal utility

An further potential avenue for research is a model that links preferences to beliefs.<sup>7</sup> In particular, suppose that utility is subject to a shock. The decision-maker is uncertain about the marginal utility of consumption, and learns about it over time

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<sup>6</sup>Related mechanisms exist in other models, e.g. Piketty (1995) and Ali (2011).

<sup>7</sup>We thank Yves Le Yaouanq for this suggestion.

by observing consumption and experienced utility. A negative utility shock (for example a stressful life event) that enters may be (incorrectly) partially attributed to the marginal utility of consumption, leading the agent to become more pessimistic about her future ability to generate utility and resulting in the behavior changes described above. For example, anticipating lower marginal utility in the future might reduce earning incentives and decrease the incentive to choose “production optimal” food and sleep consumption.

#### 4.2.3 Substitutes in the utility function

The medical literature largely mentions self-medication as the motivation for temptation good consumption in depression (Khantzian 1985). Partly this may be because of psychoactive properties of nicotine, alcohol and other drugs, which might directly interact with the belief or preference distortions induced by depression. It could also be that depression changes trade-offs in the utility function, and that such goods become more attractive substitutes when the returns to other forms of consumption diminish.

## 5 Conclusion

The goal of this paper was to make first steps in understanding depression through the lens of economic analysis. In particular, we have described the core symptoms of depression in terms of economic primitives, and present correlational data illustrating the relationship between depression and important economic variables. Finally, we have discussed two possible modeling approaches for depression: belief-based and preference-based theories. In this conclusion, we briefly discuss the relative merits of both.

The virtue of belief-based theories is that they have the potential to capture a large number of the core symptoms of depression described at the outset of the paper. In addition, belief-based theories of depression resonate with prominent psychological and psychiatric theories of depression, and the therapeutic approaches to which they gave rise. An early account of depression in the tradition of the behaviorist B. F. Skinner was provided by the psychologist Charles Ferster, who argued that depression resulted from an overexposure to negative reinforcement and underexposure to positive reinforcement in the environment (Ferster 1973). This view led to the development of Behavioral Activation therapy, which focuses on

exposing the patient to positive reinforcement. While today's treatment approaches are different, Ferster's account of the etiology of depression is closely aligned with analysis that emphasizes the importance of exposure to negative shocks.

When the cognitive revolution in psychology shifted the focus from simple stimulus-response contingencies in the tradition of Skinner to the cognitive processes that mediate an individual's responses, the classic work of the psychiatrist Aaron Beck suggested that a core reason for depression is distorted thinking (Beck 1967). Correcting such distorted thoughts is still a central element in the standard therapeutic tool to treat depression, Cognitive Behavioral Therapy (CBT). Inaccurate beliefs about the returns to effort are an example of such distorted beliefs, and the focus of CBT on correcting such beliefs may explain its effectiveness. An equally important component of CBT – correcting distorted behaviors – might also be effective by exposing individuals to more opportunities to learn that their beliefs are overly pessimistic.

However, while beliefs may be a suitable target for therapeutic efforts, a description of the symptomatology and etiology of depression purely in terms of beliefs falls short of capturing reality. Especially the emotional symptoms of depression are difficult to characterize as resulting from pessimistic beliefs. Instead, they call for a preference-based account of depression, such as the one outlined above. Nevertheless, while preference distortions caused by depression seem well aligned with some of the facts, they provide a less satisfying and potentially less helpful account than belief-based models. In particular, it is unclear how preference shocks could come about, and how practitioners might be able to treat “distorted marginal utility.” In contrast, the causal chain from shock, to belief, to behavior is very clear, and offers good targets for treatment. Future work may be able to provide richer psychological and economic foundations to preference change induced by and inducing depression, and to gather new evidence to separate preference and belief-based explanations of depression. Together, our hope is that this approach will enable economists to advance our understanding of depression in particular, and mental health in general.

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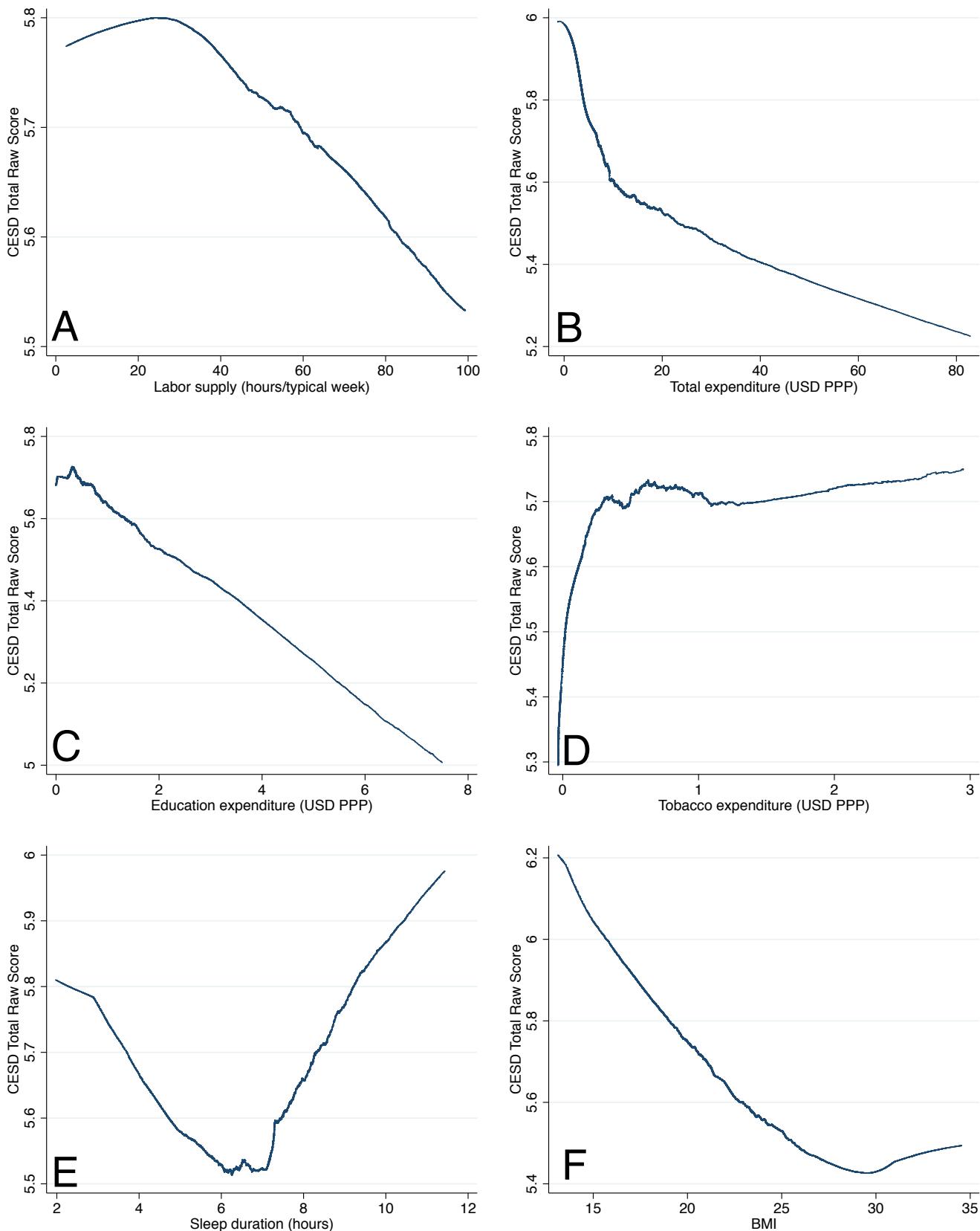
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Figure I: Relationship between depression and other variables



Notes: Local linear regressions of depression (CESD) scores on other variables. The raw CESD score ranges from 0 (not depressed) to 60 (severely depressed), with a cutoff of 16 for depression. Labor supply is measured in hours of labor supplied by the respondent in their main income-generating activity in a typical week; we exclude individuals who supplied zero or more than 100 hours of labor. Total expenditure and spending on tobacco and education is measured in USD PPP. Sleep duration is measured through self-report in hours for the preceding night. BMI is imputed from self-reports of height and weight. In each regression we first use the Frisch-Waugh theorem to create residuals from a regression of the variables of interest on gender, age, their square terms, and the interactions; we then create a new variable by adding the unconditional mean. Local linear regressions use a tricube weighting function and have a bandwidth of 0.8.

Table 1: CESD Correlations: Economic Variables

	(1) CESD Total Raw Score	(2) CESD Total Z-Score	(3) N
HH Business shut down in last 18 months	0.8077*** (0.2367)	0.1902*** (0.0557)	13095
Experienced natural disaster or civil strife	0.3967*** (0.0695)	0.0934*** (0.0164)	31401
Experienced economic disruption	0.5800*** (0.0703)	0.1366*** (0.0166)	31401

Notes: Each row is a separate regression of depression on the variable listed on the left. Each regression includes controls for sex and age. Standard errors are clustered at the household level and are reported in parenthesis below the coefficient estimate. \* denotes significance at 10 pct., \*\* at 5 pct., and \*\*\* at 1 pct. level.

## Appendix

### A Major Depressive Disorder: DSM-5 Diagnostic Criteria

A. Five (or more) of the following symptoms have been present during the same 2-week period and represent a change from previous functioning: at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure.

**Note:** Do not include symptoms that are clearly attributable to another medical condition.

- (a) Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad, empty, hopeless) or observation made by others (e.g., appears tearful). (**Note:** In children and adolescents, can be irritable mood.)
- (b) Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation).
- (c) Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day. (**Note:** In children, consider failure to make expected weight gain.)
- (d) Insomnia or hypersomnia nearly every day.
- (e) Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down).
- (f) Fatigue or loss of energy nearly every day.
- (g) Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick).
- (h) Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others).
- (i) Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan

for committing suicide.

- B. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.
- C. The episode is not attributable to the physiological effects of a substance or to another medical condition.

**Note:** Criteria A–C represent a major depressive episode.

**Note:** Responses to a significant loss (e.g., bereavement, financial ruin, losses from a natural disaster, a serious medical illness or disability) may include the feelings of intense sadness, rumination about the loss, insomnia, poor appetite, and weight loss noted in Criterion A, which may resemble a depressive episode. Although such symptoms may be understandable or considered appropriate to the loss, the presence of a major depressive episode in addition to the normal response to a significant loss should also be carefully considered. This decision inevitably requires the exercise of clinical judgment based on the individual's history and the cultural norms for the expression of distress in the context of loss.<sup>8</sup>

- D. The occurrence of the major depressive episode is not better explained by schizoaffective disorder, schizophrenia, schizopreniform disorder, delusional disorder, or other specified and unspecified schizophrenia spectrum and other psychotic disorders.

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<sup>8</sup>In distinguishing grief from a major depressive episode (MDE), it is useful to consider that in grief the predominant affect is feelings of emptiness and loss, while in MDE it is persistent depressed mood and the inability to anticipate happiness or pleasure. The dysphoria in grief is likely to decrease in intensity over days to weeks and occurs in waves, the so-called pangs of grief. These waves tend to be associated with thoughts or reminders of the deceased. The depressed mood of MDE is more persistent and not tied to specific thoughts or preoccupations. The pain of grief may be accompanied by positive emotions and humor that are uncharacteristic of the pervasive unhappiness and misery characteristic of MDE. The thought content associated with grief generally features a preoccupation with thoughts and memories of the deceased, rather than the self-critical or pessimistic ruminations seen in MDE. In grief, self-esteem is generally preserved, whereas in MDE feelings of worthlessness and self-loathing are common. If self derogatory ideation is present in grief, it typically involves perceived failings vis-à-vis the deceased (e.g., not visiting frequently enough, not telling the deceased how much he or she was loved). If a bereaved individual thinks about death and dying, such thoughts are generally focused on the deceased and possibly about "joining" the deceased, whereas in MDE such thoughts are focused on ending one's own life because of feeling worthless, undeserving of life, or unable to cope with the pain of depression.

E. There has never been a manic episode or a hypomanic episode.

**Note:** This exclusion does not apply if all of the manic-like or hypomanic-like episodes are substance-induced or are attributable to the physiological effects of another medical condition.

### **Diagnostic Features**

The criterion symptoms for major depressive disorder must be present nearly every day to be considered present, with the exception of weight change and suicidal ideation. Depressed mood must be present for most of the day, in addition to being present nearly every day. Often insomnia or fatigue is the presenting complaint, and failure to probe for accompanying depressive symptoms will result in under diagnosis. Sadness may be denied at first but may be elicited through interview or inferred from facial expression and demeanor. With individuals who focus on a somatic complaint, clinicians should determine whether the distress from that complaint is associated with specific depressive symptoms. Fatigue and sleep disturbance are present in a high proportion of cases; psychomotor disturbances are much less common but are indicative of greater overall severity, as is the presence of delusional or near-delusional guilt.

The essential feature of a major depressive episode is a period of at least 2 weeks during which there is either depressed mood or the loss of interest or pleasure in nearly all activities (Criterion A). In children and adolescents, the mood may be irritable rather than sad. The individual must also experience at least four additional symptoms drawn from a list that includes changes in appetite or weight, sleep, and psychomotor activity; decreased energy; feelings of worthlessness or guilt; difficulty thinking, concentrating, or making decisions; or recurrent thoughts of death or suicidal ideation or suicide plans or attempts. To count toward a major depressive episode, a symptom must either be newly present or must have clearly worsened compared with the person's pre-episode status. The symptoms must persist for most of the day, nearly every day, for at least 2 consecutive weeks. The episode must be accompanied by clinically significant distress or impairment in social, occupational, or other important areas of functioning. For some individuals with milder episodes, functioning may appear to be normal but requires markedly increased effort.

The mood in a major depressive episode is often described by the person as depressed, sad, hopeless, discouraged, or "down in the dumps" (Criterion A1). In some cases, sadness may be denied at first but may subsequently be elicited by

interview (e.g., by pointing out that the individual looks as if he or she is about to cry). In some individuals who complain of feeling "blah," having no feelings, or feeling anxious, the presence of a depressed mood can be inferred from the person's facial expression and demeanor. Some individuals emphasize somatic complaints (e.g., bodily aches and pains) rather than reporting feelings of sadness. Many individuals report or exhibit increased irritability (e.g., persistent anger, a tendency to respond to events with angry outbursts or blaming others, an exaggerated sense of frustration over minor matters). In children and adolescents, an irritable or cranky mood may develop rather than a sad or dejected mood. This presentation should be differentiated from a pattern of irritability when frustrated.

Loss of interest or pleasure is nearly always present, at least to some degree. Individuals may report feeling less interested in hobbies, "not caring anymore," or not feeling any enjoyment in activities that were previously considered pleasurable (Criterion A2). Family members often notice social withdrawal or neglect of pleasurable avocations (e.g., a formerly avid golfer no longer plays, a child who used to enjoy soccer finds excuses not to practice). In some individuals, there is a significant reduction from previous levels of sexual interest or desire.

Appetite change may involve either a reduction or increase. Some depressed individuals report that they have to force themselves to eat. Others may eat more and may crave specific foods (e.g., sweets or other carbohydrates). When appetite changes are severe (in either direction), there may be a significant loss or gain in weight, or, in children, a failure to make expected weight gains may be noted (Criterion A3).

Sleep disturbance may take the form of either difficulty sleeping or sleeping excessively (Criterion A4). When insomnia is present, it typically takes the form of middle insomnia (i.e., waking up during the night and then having difficulty returning to sleep) or terminal insomnia (i.e., waking too early and being unable to return to sleep). Initial insomnia (i.e., difficulty falling asleep) may also occur. Individuals who present with oversleeping (hypersomnia) may experience prolonged sleep episodes at night or increased daytime sleep. Sometimes the reason that the individual seeks treatment is for the disturbed sleep.

Psychomotor changes include agitation (e.g., the inability to sit still, pacing, handwringing; or pulling or rubbing of the skin, clothing, or other objects) or retardation (e.g., slowed speech, thinking, and body movements; increased pauses before answering; speech that is decreased in volume, inflection, amount, or variety of con-

tent, or muteness) (Criterion A5). The psychomotor agitation or retardation must be severe enough to be observable by others and not represent merely subjective feelings.

Decreased energy, tiredness, and fatigue are common (Criterion A6). A person may report sustained fatigue without physical exertion. Even the smallest tasks seem to require substantial effort. The efficiency with which tasks are accomplished may be reduced. For example, an individual may complain that washing and dressing in the morning are exhausting and take twice as long as usual.

The sense of worthlessness or guilt associated with a major depressive episode may include unrealistic negative evaluations of one's worth or guilty preoccupations or ruminations over minor past failings (Criterion A7). Such individuals often misinterpret neutral or trivial day-to-day events as evidence of personal defects and have an exaggerated sense of responsibility for untoward events. The sense of worthlessness or guilt may be of delusional proportions (e.g., an individual who is convinced that he or she is personally responsible for world poverty). Blaming oneself for being sick and for failing to meet occupational or interpersonal responsibilities as a result of the depression is very common and, unless delusional, is not considered sufficient to meet this criterion.

Many individuals report impaired ability to think, concentrate, or make even minor decisions (Criterion A8). They may appear easily distracted or complain of memory difficulties. Those engaged in cognitively demanding pursuits are often unable to function. In children, a precipitous drop in grades may reflect poor concentration. In elderly individuals, memory difficulties may be the chief complaint and may be mistaken for early signs of a dementia ("pseudodementia"). When the major depressive episode is successfully treated, the memory problems often fully abate. However, in some individuals, particularly elderly persons, a major depressive episode may sometimes be the initial presentation of an irreversible dementia.

Thoughts of death, suicidal ideation, or suicide attempts (Criterion A9) are common. They may range from a passive wish not to awaken in the morning or a belief that others would be better off if the individual were dead, to transient but recurrent thoughts of committing suicide, to a specific suicide plan. More severely suicidal individuals may have put their affairs in order (e.g., updated wills, settled debts), acquired needed materials (e.g., a rope or a gun), and chosen a location and time to accomplish the suicide. Motivations for suicide may include a desire to give up in the face of perceived insurmountable obstacles, an intense wish to end

what is perceived as an unending and excruciatingly painful emotional state, an inability to foresee any enjoyment in life, or the wish to not be a burden to others. The resolution of such thinking may be a more meaningful measure of diminished suicide risk than denial of further plans for suicide.

The evaluation of the symptoms of a major depressive episode is especially difficult when they occur in an individual who also has a general medical condition (e.g., cancer, stroke, myocardial infarction, diabetes, pregnancy). Some of the criterion signs and symptoms of a major depressive episode are identical to those of general medical conditions (e.g., weight loss with untreated diabetes; fatigue with cancer; hypersomnia early in pregnancy; insomnia later in pregnancy or the postpartum). Such symptoms count toward a major depressive diagnosis except when they are clearly and fully attributable to a general medical condition. Non-vegetative symptoms of dysphoria, anhedonia, guilt or worthlessness, impaired concentration or indecision, and suicidal thoughts should be assessed with particular care in such cases. Definitions of major depressive episodes that have been modified to include only these non-vegetative symptoms appear to identify nearly the same individuals as do the full criteria.

### **Associated Features Supporting Diagnosis**

Major depressive disorder is associated with high mortality, much of which is accounted for by suicide; however, it is not the only cause. For example, depressed individuals admitted to nursing homes have a markedly increased likelihood of death in the first year. Individuals frequently present with tearfulness, irritability, brooding, obsessive rumination, anxiety, phobias, excessive worry over physical health, and complaints of pain (e.g., headaches; joint, abdominal, or other pains). In children, separation anxiety may occur.

Although an extensive literature exists describing neuroanatomical, neuroendocrinological, and neurophysiological correlates of major depressive disorder, no laboratory test has yielded results of sufficient sensitivity and specificity to be used as a diagnostic tool for this disorder. Until recently, hypothalamic-pituitary-adrenal axis hyperactivity had been the most extensively investigated abnormality associated with major depressive episodes, and it appears to be associated with melancholia, psychotic features, and risks for eventual suicide. Molecular studies have also implicated peripheral factors, including genetic variants in neurotrophic factors and pro-inflammatory cytokines. Additionally, functional magnetic resonance imaging

studies provide evidence for functional abnormalities in specific neural systems supporting emotion processing, reward seeking, and emotion regulation in adults with major depression.

## B Summary of the literature on economic causes of depression

The related economics literature almost exclusively studies mental well-being as an outcome, often as a component of a more holistic view of well-being than conventional measures such as income or consumption. We provide a brief review of that literature here, discussing studies of the effects of unemployment, fear of unemployment, wealth shocks, crime and fear of crime, and social comparisons. For brevity, we focus on the studies that explicitly seek causal identification, through use of panel data techniques, natural experiments, instrumental variables or field experiments. Most studies use composite measures of mental well-being, but we highlight those that specifically measure depression prevalence or incidence.

### Unemployment and fear of unemployment

It is well documented that depression rates are much higher among the unemployed, but causality could run in both directions. In our theory, we would interpret an unemployment shock (or fear of unemployment) as a shock to an individual's perceived future returns to her labor.

Clark (2003) uses the the British Household Panel Survey (BHPS) (from 1991/2-1997/8) and studies the GHQ-12 composite measure of mental well-being, which includes questions on depression, as well as "feelings of strain", and insomnia. Mental well-being is significantly lower among the unemployed and among those whose partner is unemployed. In fixed-effects regressions he shows that mental well-being falls when an individual moves into unemployment and increases when he/she moves into employment.

Marcus (2013) uses the German Socio-Economic Panel (2002-2010) to study the impact of plant closures on composite mental health, measured by the Mental Component Summary Scale (MCS). Households that experienced a job loss due to plant closure during the period are matched on observables to households that did not, and the plant closure effect estimated by difference-in-differences. He finds approximately equal negative effects on mental health from own or spouse's unemployment – only in seven households did both members become unemployed so he cannot study the interaction considered by Clark (2003) (see below). Our framework focuses on private returns of a representative agent and cannot directly speak to depression induced by shocks to a close family member, except to the extent that they induce

pessimism about own returns.

Farré, Fasani, and Mueller (2015) use the Spanish Health Survey (2006 and 2011 waves) to estimate the causal effect of job loss on mental health. They exploit the collapse of the Spanish construction industry since 2007 as a source of exogenous negative to both short and long run employment for construction workers.<sup>9</sup> Key outcomes of interest are diagnoses of, and self-reported, mental disorders (depression or chronic anxiety). In addition, they study responses to the GHQ-12 questions. The identification strategy is instrumental variables, with location specific exposure to construction as the instrument. They find a statistically significant 1.1 standard deviation in mental disorder diagnoses, and a 0.9 standard deviation in mental health as measured by GHQ-12. Closely in line with our theory, they write “[the shock] led to long unemployment spells, hopelessness and feelings of uselessness.”

Colantone, Crinò, and Ogliari (2015) use the BHPS (2001-2007) to study the effect of import competition in an individual’s industry on his/her mental distress, measured using GHQ-12. Using individual fixed-effects regressions, they find that a one standard deviation increase in import competition (defined as the ratio of imports to national consumption) in the individual’s industry leads to a decline of 0.13 standard deviations in the GHQ-12 index. Splitting out the components, they find particularly large effects on anxiety and depression, and. Analyzing mechanisms, they use a two step procedure to study how import competition feeds through to final mental health outcomes. They find support for the effect working through decreased job security, lower wage growth, and lower job satisfaction particularly regarding workload. We interpret these findings as closely aligned with our theory.

### Wealth shocks

While our theory only considers wealth shocks that operate through the return to labor, the link we invoke from anticipated future consumption to mood also naturally carries over to shocks to non-labor income. We highlight two studies of the effect of stock market losses on the mental health of retirees.

McInerney, Mellor, and Nicholas (2013) study the effect of wealth shocks on mental health in the US Health and Retirement Study (HRS), exploiting exogenous

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<sup>9</sup>They argue that a key advantage of this natural experiment (as opposed to plant closures) is it enables the study of long-run effects since it was very hard for unemployed, low-education construction workers to re-enter employment, while those laid off because of a plant closure might re-enter employment differentially according to their (mental) health status.

variation in interview dates: some individuals in the 2008 wave were surveyed before the October stock market crash, and some after. They find that antidepressant use and self-reported measures of depression and mental health worsened after the crash. Notably the effect was strongest for individuals with high stock holdings. However clinically validated measures based on the CES-D showed no systematic effects.

Schwandt (2015) also uses the HRS to study wealth shocks, extending the analysis to the 1998-2011 waves. He constructs individual-specific exposure to stock market shocks by measuring individual stock market participation. He finds strong negative effects on both physical health and depression (using the CES-D).

### **Crime and fear of crime**

One interpretation in line with our theory is that recent crime experience or exposure induces fear of future crime and which either directly reduces the return to labor effort (through theft or destruction of property) or indirectly because of lost productivity caused by the crime event, particularly when violence is involved.

Cornaglia, Feldman, and Leigh (2014) use the Household, Income and Labour Dynamics in Australia (HILDA) survey from 2002-2006, and measure mental health outcomes using subsets of the 36-Item Short Form Health Survey (SF-36). We are primarily interested in their Mental Health scale, using five questions that focus on depression and nervousness. In individual fixed-effects regressions, they find a negative relationship between recent experience of violent crime and mental health, and also between local crime rates and mental health. They find smaller, not significant effects from property crime.

Dustmann and Fasani (2016) study the BHPS, focusing also on the GHQ-12 index which they divide into separate components including an Anxiety and Depression component. In individual fixed-effects regressions they find that increases in the local crime rate harm mental health, including anxiety and depression. In contrast with Cornaglia, Feldman, and Leigh (2014), and closer in spirit to our theory, the effect of property crime is statistically significant while violent crime is not. Dustmann and Fasani (2016) also use data from the English Longitudinal Study of Ageing (ELSA) of individuals aged 50 and over, which contains a direct measure of depression, the Psychosocial Health Module (PSH) based on the Centre for Epidemiologic Studies Depression Scale (CES-D) which we also use. They find that increases in local crime rates, both violent and property crime, lead to increases in depression rates.

## Socioeconomic environment

We highlight two sets of studies that can be thought of as analyzing the effects of changes to peer group composition or outcomes on own mental health.

Katz, Kling, and Liebman (2001) study the two-year impacts of the well-known Moving to Opportunity program (at the Boston site), in which poor households were randomly assigned subsidies to move to low-poverty neighborhoods, or rent subsidies that could be used in any neighborhood. Income and employment did not change relative to control, but the predicted probability of a Major Depressive Episode<sup>10</sup> fell by five to ten percentage points (not statistically significant) from a baseline of 25 to 35 percent. Medium-run effects (four to seven years), studied in Kling, Liebman, and Katz (2007), are more positive – poverty rates declined and mental health outcomes, both for depression specifically as well as composite measures, improved substantially. The effect on mental health is also shown to be larger the lower is the poverty rate of the new neighborhood. Finally, Ludwig et al. (2012) study long-run effects (10-15 years), finding persistently lower poverty rates and (marginally significant) improvements in composite mental health. We note also that an additional channel discussed in these papers is through the fear of crime, and that fear of crime declined after moving to better neighborhoods.

In contrast with these positive effects of low relative socioeconomic status on mental health outcomes, a second set of studies suggests negative effects. Luttmer (2005) studies the relationship between neighbors' average earnings on individuals' self-reported happiness, and finds a negative effect, holding constant the individual's own income. Similarly, Baird, Hoop, and Özler (2013) and Haushofer, Reisinger, and Shapiro (2015) provide evidence of negative spillovers of cash transfer programs in Malawi and Kenya on neighbors' psychological well-being. Clark (2003), discussed above, studies the interaction between own unemployment and unemployment in three reference groups: the spouse or partner, household members, and the region. He finds a moderating effect: the mental well-being of the unemployed is higher when the unemployment rate among plausible reference groups is higher (spouse or partner, household members, region).

The two sets of findings seem to conflict – the Moving to Opportunity experiment decreased the relative standing of the treated households relative to their neighbors, and increased mental well-being, while the remainder of the studies suggest an op-

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<sup>10</sup>A measure constructed from the Composite Diagnostic Interview Short Form (CIDI-SF).

posite effect of peer comparisons. However, Moving to Opportunity also improved the *absolute* prospects of the treated households as seen in the poverty and crime exposure results, and this may have outweighed the relative effects.