

**Where's Waldo?**

**The Mis-Characterization of Objective Functions in Macroeconomics**

**George A. Akerlof\***

**August 18, 2004**

**This is a first draft of the Presidential Address to the American Economic Association of January, 2007. Comments are very welcome. This draft is *very preliminary* and should not be distributed.**

\*The basis of this paper comes out of the research program with Rachel Kranton and is based on our joint papers Akerlof and Kranton (2000), (2002), (2004). The basic idea of a utility function that is dependent of what people think ought to be done comes from our joint work, as articulated in Akerlof and Kranton (2002) and (2004). Some of the ideas on methodology, which also owe their origin to that same research program have been also expressed in Akerlof (2004). I also wish to thank Janet Yellen and Robert Akerlof for sage advice. E-mail address: [akerlof@econ.berkeley.edu](mailto:akerlof@econ.berkeley.edu).

## I. Introduction

Modern macroeconomists have many strange beliefs.

*Ricardian Equivalence:* They will tell you that under somewhat special conditions that a person who receives more money in social security payments will not spend a single dime extra, but will instead pass on the whole amount, dollar for dollar because their heirs will have to pay higher tax bills..

*The Modigliani-Miller Theorem:* They will tell you that under also somewhat special conditions a corporation president whose company has made a large windfall profit will not spend any more investment dollars. He will instead pass the money on to his shareholders or seek other financial investments since he will only make investments whose risk-adjusted rate of return exceeds the rate of return on capital.

*Natural Rate Theory:* They will tell you that there is some single natural rate of unemployment that is the only level that could be permanently maintained without ever increasing inflation or ever increasing deflation. A fiscal/monetary policy mix that sought to maintain a rate that was any lower would result in permanently increasing inflation; if any higher, there would be permanently decreasing inflation.

*Rational Expectations:* In addition, some macroeconomists will tell you that the choice of the systematic part of monetary policy will have no implications whatsoever on the stability of the macroeconomy.

Let me not overstate my case. Most macroeconomists believe natural rate theory actually describes real economies. But most also have considerable doubts that Ricardian equivalence,

the Modigliani-Miller theorem, or rational expectations theory actually describes real-world behavior. But they would also believe that these propositions would apply in a frictionless world.

I have the same view of frictions as these economists. Frictions include a long list of things such as tax distortions, uncertainty, corner conditions on credit availability, asymmetric information, and borrowing/lending rates that differ by individual. But I do not think that any of these four propositions will hold even in the absence of such frictions. I do not think they hold because in each case these propositions mis-characterize the objective function of the respective economic actors.

Who is Waldo? Waldo is the mis-characterization of the objective function that leads to the relevant neutrality result. In the subsequent sections of this lecture I shall seek to describe Waldo for each the four neutrality results.

In each case we shall see a Waldo with very much the same look. In each case the neutrality result in question, in the absence of frictions, occurs because the objective function is purely utilitarian. In each case the decision-maker is maximizing a utility function that is based only on *objective* criteria. It has failed to take account of the decision maker's *subjective* view. A psychologist would say that the neutrality results only hold because the model fails to account for the decision maker's *mental frame*. In each case the decision-maker is given a purely utilitarian mental frame. But other perhaps even more plausible accounts of that mental frame will respectively deliver results that are far from the neutrality propositions of Ricardian equivalence, Miller-Modigliani, natural rate theory, or rational expectations. They do so even in the absence of frictions.

In finding Waldo in each of the cases above I shall answer a paradox: Why were the post-War Keynesian economists so genuinely surprised by each of these four respective neutrality propositions? This earlier generation of macroeconomists derived their descriptions of macroeconomic functions such as the consumption function, the investment function, the demand for money, and the Phillips Curve from their observations of behavior. In contrast those who came later felt that they had to be *scientists*, so that they should derive behavior from theory. That meant derivation of behavior from profit functions and utility functions. In each case the objective functions were too narrow. Standard economic method is to posit objective functions with only objective arguments. There was no place in these objective functions for the mental frame of the decision maker. This is where Waldo is hiding. It was difficult to see what was left out in this theoretical methodology. It was difficult to see that this methodology was systematically failing to take account of the subjective mental frame of the decision maker, and how those subjective considerations were non-utilitarian.<sup>1</sup> In each of these four cases that I have cited, this utility/profit maximization gave results that were quite different, even in the absence of frictions, from the behaviors that had previously been ascribed.

Beginning with the seminal article by Kahneman and Tversky, economists have been increasingly exploring the extent to which decision makers are influenced by their respective mental frames. Kahneman and Tversky suggested that individuals do not just care about physical outcomes; in prospect theory, individuals also do not like to take what they consider to

---

<sup>1</sup>Some years ago, at a conference in Spoleto, Italy Edmund Phelps gave a still unpublished lecture wondering why the economics of the 20<sup>th</sup> Century had failed to discover what was central to most of the arts, which was the role of subjectivity. This paper is about the direct relevance of such subjectivity for macroeconomics. I have very much benefitted from enjoyable conversations with Professor Phelps. He has summarized for me the content of that talk in an email.

be *losses*. Prospect theory explains a large number of experimental outcomes. What subjects consider respectively as gains and or losses, however, is not based on an objective reality; it is the result of a *subjective* mental frame.

We can view prospect theory as a special example of a more general type of mental frame, which was first explored by Pareto. Pareto said that individuals do not just care about real economic outcomes; in addition they have many notions as to how they and others *should* behave. He said that social scientists should always pay attention to beliefs about what people *should* or *should not* do. Following Pareto, such beliefs, which are commonly called norms, are important components of utility functions. Loss aversion can be viewed as a special case of such norms; those with loss aversion believe that they *should not* take losses.

I shall show that giving people simple beliefs about how they and others *should* or *should not* behave easily explains each of the respective macroeconomic neutrality paradoxes. In the case of Ricardian equivalence, individuals' consumption behavior is affected by how much they think they should or should not consume. In the case of the Modigliani-Miller theorem, managers' behavior is determined by the role they think they should be playing as firm managers. And, regarding the natural rate and rational expectations theory, price and wage determination is influenced by the views of buyers and sellers of goods and labor regarding the prices and wages that they think *should* be paid. In each case even in the absence of frictions the respective neutrality results are either unlikely to hold or have much less generality than currently thought.

The peculiar macroeconomic neutralities thus should not be viewed as indications of how frictionless macroeconomies behave. Rather their strange results should be viewed as indicators

of missing motivations. In this regard they also have a message for the field of economics. Macroeconomists are not the only ones with a blind spot to the role of mental framing in economic models. An example demonstrates. For some time economists have been well-aware that expected-utility maximizers will be approximately risk neutral over small-stake gambles. Nevertheless they persisted until recently in widespread belief that the risk avoidance in experiments and in other real-life situations with relatively small stakes was the result of risk aversion with a concave utility function over wealth. But calibrations by Rabin (2000) have shown that expected-utility maximizers will be extremely close to risk neutral even with medium-sized stakes. In contrast, prospect theory gives a clean explanation for the experimental results, as subjects can be expected to define *losses* in the context of the experimental situation. Economists' failure to understand the role of mental framing in such risk-avoidance behavior suggests a failure to understand its role much more generally, not just in the area of macroeconomics.

The rest of this lecture proceeds as follows. The next three sections will deal respectively with the missing subjective motivation in derivation of consumption functions, investment functions, and price and wage behavior. In each case I shall show the consequences for the corresponding surprising neutrality results. I shall then reflect on the general methodological reasons why economists have systematically mis-characterized these decision makers' objective functions, and the implications of economists' narrow methodological assumptions regarding both economic theory and empirical work. I shall then summarize and conclude.

## **II. Consumption**

The natural place to begin our discussion of neutrality results is Ricardian equivalence. This is the simplest of the neutrality propositions; if there is missing motivation in the objective function, it should be easiest to see here.

The essence of Ricardian equivalence can be seen in a model with just two generations, a parent and a child.<sup>2</sup> The parent maximizes a utility function with two arguments, his own consumption and the utility of his child. The heir's utility only depends on his own consumption. Such a simple utility function then can be expressed as:

$$U = U_1(c_1, U_2(c_2)),$$

where  $c_1$  is the consumption of the parent,  $c_2$  is the consumption of the child,  $U_1$  is the utility of the parent and  $U_2$  is the utility of the child. The parent chooses his consumption and his bequest to this child, subject to the budget constraint that this consumption and this bequest must add up to his wealth (including his wealth from human and nonhuman capital earnings). What the parent has left over is passed on the child with interest as a bequest. Now suppose that in the first generation the government taxes the parent less, builds up its debt; then in the subsequent generation the government increases its taxes on the child in order to pay off the additional principle of the added debt and the interest on it.<sup>3</sup> Will that lead the parent to consume more? If

---

<sup>2</sup>This model is a simplification of Barro's model. His model had a sequence of overlapping generations, each of which lived for two periods, young and old. Barro's contribution was not only to show Ricardian equivalence in the two-generation model, but also its extension to a sequence of generations when parents' utility only depended on their own utility and the utility of their own children. Ricardo's discussion, which is close to the two-generation model here, was then subsequently rediscovered.

<sup>3</sup>There is no uncertainty and all taxes are lump-sum. This proposition may be generalized, for example, following Barro to a model with  $m$  overlapping generations each of which have different consumption when young and old. Each parent derives utility from his own consumption and the utility of his child.

the parent is maximizing  $U$ , as long as the increase in the debt does not exceed the bequest of the parent, there will be no change in the consumption of the parent.

The preceding model may be a very good model of how a utilitarian parent would ideally balance the utility of himself and his children. But there remains the question whether the first-generation consumer will act as if he is maximizing such a utility function. In my view such a maximization is only one part of the utility function in mind by the original Keynesians. In my view they saw the consumer as looking at his consumption in a very different way. The consumer first made an assessment of what money he had available to spend. This money would take two forms. First he would have his current earnings net of taxes. This is money that he had from one source. He might also have a stock of assets, or wealth, in addition. He would view each of these as resources that were *his* and that were available for him to spend as he saw fit. He would then have an opinion as to how he thought that this money of *his* should be divided up between his needs and the future needs of his children. He would have a rule then as to how he would think that such resources of *his* ought to be spent between different needs. In addition to the purely utilitarian component of his utility, that would add a second component, which we shall call  $V$ .

This more complicated Paretian parent then has a utility function of the form

$$U = U_1(c_1, U_2(c_2)) + V(c_1*(Y - T, W), c_1, c_2),$$

where  $Y$  is current income,  $T$  is taxes, and  $W$  is nonhuman assets. The argument,  $V$ , tells us that his economic assets of income (net of taxes) and wealth that he considers to be *his*, the parent has a view as to how he should allocate his expenditure to himself and to his heir. That allocation may be altered by the purely utilitarian part of the argument,  $U$ , which depends upon

the direct utility that he gets from his own consumption and also from his altruistic concern for the utility of his child. For the usual Paretian parent one would expect that the greater the government deficit in the current generation the lower would be taxes and the greater would be the amount of money that he would consider to be *his*. That of course is the Keynesian intuition. If  $V$  dominates people's considerations of how much they should consume and how much they should save, then we would probably not be surprised to obtain a standard Keynesian consumption function, with consumption dependent on disposable income and wealth. Feldstein's estimates of the effects of social security wealth on savings relies on such a consumption function. The consumer with a mental image of the resources which are *hers* to spend and a notion of how those resources should be divided between herself and her heirs is likely to spend more if she receives more income that is *hers* by social security payments.

There is an extensive literature on Ricardian equivalence, with at least two excellent reviews at least through the 1980s, by its Barro (1989), its modern proponent, and by Seater (1993). Each of these reviews give lists of frictions that explain possible failure for Ricardian equivalence. For example, following Seater (1) horizons may not be finite, but instead infinite; (2) altruism may not be the only reason for bequest motives; (3) a significant number of families are childless; (4) uncertainty may affect the result; (5) the government and the public may have differential borrowing rates; (6) the growth rate of the economy may exceed the interest rate allowing steady debt issuance without ever paying back the principal; (7) people may not foresee the effect of increased taxes on the next generation; (8) some debt is not domestically owned, but by foreigners; and (9) almost all taxes are distortionary, contrary to the model.

Each of these nine reasons may explain why there may be departures from Ricardian

equivalence in reality. None of them can explain the theoretical novelty of Barro's derivation of Ricardian equivalence in the *frictionless* model. That surprise can only have occurred because that derivation implies that the popular conceptions of the consumption function at the time could not be derived from standard utility maximization. Those conceptions would require much more general utility functions than those based solely on objective economic outcomes. Following Pareto such utility functions would have a  $V$ -component to utility, which is derived from tastes regarding how people think they and others should behave, as an important, and perhaps even dominant component of the objective function determining consumption. With regard to Ricardian equivalence we have found Waldo. The absence of a  $V$  function is the mischaracterization of utility that results in Ricardian equivalence in a frictionless world.

Another approach to Ricardian equivalence, by Bernheim and Bagwell (1988), shows that the assumptions that give rise to Ricardian equivalence produces many other neutrality results that are yet more counterintuitive than the neutrality of government debt. Given the nature of real families, and the network of gifts between them, Ricardian equivalence should extend way beyond the simple parent-child family. This extension of Barro's result to areas where it is especially dubious is useful because it casts doubt on the empirical relevance of Ricardian equivalence. The presence of a further  $V$  function seems to be an especially good solution to the extended problem of Bagwell and Bernheim. The literature on gift-giving is of course replete with the notion that it is determined by what assets people consider to be *theirs* and how much of those assets should be given to *others* (Benedict (1946)).

*Some evidence in favor of a V function.* Indeed we think that there is evidence—surely not as direct or as much as we would like, but at least some—that indicates that how much people

think they *ought* to consume may be quite influential in savings decisions. Studies by Madrian and Shea (2001) and Choi, Laibson, and Madrian (2004) indicate that employees are remarkably sensitive to default options for 401(k) saving. They observed the time of sign-up and also the contributions of employees in companies that switched to automatic-default plans. Employees are much more likely to sign up for the plans when that is their automatic default, and their contribution is also extremely likely to be at the automatic default rate. Even observation over extended rates of time show quite low hazard for opting either out of the plan or out of the default contribution. This behavior suggests that employees do not really know what to save; the U-component of their consumption decision has low weight, and they look to some outside standard, in this case the company default rate, as an indication of how much they *should* be putting into retirement saving. These default rates affect employees' views of what they think they should be saving so that a change in the default is likely to get them to change their savings. In terms of our formal model the shift in the default rate generates also a shift in the  $V$  function. The success of the Save More Tomorrow Plans of Benartzi and Thaler (2004) in increasing savings gives another indication that employees' saving behavior can be changed by indications that they are not saving "enough." In these plans workers are given the chance to pre-commit to increase their 401(k) savings contributions at future dates, in some cases timing them to coincide with wage and salary increases. Benartzi and Thaler found that such plans had large effects on savings at three different companies. It appears that shifts in the  $V$ - function that occur when employees are reminded that they are not saving *enough* are sufficient to change their retirement-account contributions.

*The Keynesian Consumption Function.* Notably, it turns out that our model, with its

division between consumption as determined by maximization of both a  $V$  function and a  $U$  function, of subjective and objective components of utility, corresponds much more closely to Keynes' description of the consumption function than later derivations of consumption from global utility maximization. Keynes describes the consumption function in two parts. Most notably he thinks that the primary determinant of consumption is current income. He explains this as follows:

The fundamental psychological law, upon which we are entitled to depend with great confidence both *a priori* from our knowledge of human nature and from the detailed facts of experience, is that men are disposed, as a rule and on the average, to increase their consumption as income increases, but not by as much as the increase in income (1936, p. 96).

Relative to this dependence of consumption on income, which Keynes clearly views as primary, he then discusses a large number of possible “influence[s]” (*sic*) on this relation between income and consumption, such as a change in the wage unit, a change in the difference between income and net income, windfall changes in capital values, changes in the rate of time discounting, changes in fiscal policy, changes in expectations of the relation between the present and the future level of income.<sup>4</sup>

Why does Keynes describe consumption in this way. He has here all the ingredients of the much more modern derivations by Friedman (and also Modigliani) of consumption as a function of wealth? I believe that there are two reasons. The first reason comes from Keynes' economic training as a Marshallian economist. A Marshallian of his time might have described demand curves and supply curves in similar fashion. In these terms a demand curve or a supply curve would reflect a fundamental relation; a large number of influences could shift the demand

---

<sup>4</sup>Keynes considers all of the objective influences on consumption. In his next chapter he has another list of possible variables that will affect the income-consumption relationship.

curve, or the supply curve, respectively.

But it is also clear that Keynes is not viewing the consumption function as being just derived from the consumer's objective utility. Instead he describes the consumption function as "a psychological law." Indeed if we put income in the  $V$  function and let the  $U$  function take care of all of the standard economic arguments that describe the utility-maximizing consumer, it is natural to describe the consumption function in Keynes' way. There is a primary relation between consumption and income, as described by the presence of income in the  $V$  function, but how the consumer will behave in practice will be tempered by standard utilitarian concerns, as described by the  $U$ -component to utility. The presence of income in the  $V$  function incorporates what we would now call the consumers' mental frame into the consumer's decision-making. Keynes had a less modern name for the resultant relation between consumption and income.. He called it a *psychological law*.

### **III. Investment**

Modigliani-Miller (1958) described conditions under which firms' investment would be independent of their finance decisions. This was a remarkable theoretical discovery. The dominant thinking on firm fixed investment at the time held that it was largely reliant on firms' retained earnings. (see for example Meyer and Kuh (1957)). Now, almost 50 years later, economists have reverted to investment functions that depend largely on retained earnings, but the logic behind that view is now more careful. In addition to frictional and asymmetric-information reasons why such neutrality does not hold, finance economists (especially following Jensen and Meckling (1976)) have pointed their finger at the Miller-Modigliani assumption that managers were maximizing the

interest of share-holders, not their own interest. Consistent with our finding relative to Ricardian equivalence, a different objective function then negates the neutrality and restores the old view derived from the Keynesians' observations and common sense. We shall see that objective functions that include a notion by managers about what they *should* or *should not* be doing can also account for lack of independence between decisions regarding investment and finance.

The Miller-Modigliani argument for independence of the finance decision and the investment decision proceeds as follows. It first considers an initial equilibrium of a competitive-general equilibrium economy with an initial level of firm debt and initial investment decisions. It is assumed that this investment decision is made in such a way as to maximize share-holder value. It then argues that if a firm increases its debt there will be a new equilibrium with the same investment decisions. In that new equilibrium the shareholders of the firm have increased their loans in their respective private portfolios by an amount exactly corresponding to the ownership implicit in their stock holdings of the firm's increased debt. If the markets for debt cleared in the old equilibrium, they would again clear in the new. If managers' choice of investment maximized share-holder value in the old equilibrium, the same choice of investment would maximize it in the new.

Of course Miller-Modigliani neutrality will not hold in the presence of frictions such as tax distortions. Also asymmetry of information between managers and shareholders gives a reason why firms will not be indifferent about their financial position. Higher levels of debt suggest existing owners' lack of confidence in the firm's prospects.<sup>5</sup> But it also well-known, following

---

<sup>5</sup>The change in the ownership of the debt from the individual will in most systems have non-neutral tax consequences. The firm will have decreased corporate profits by the amount of the increased interest on its debt. If it pays those earnings out as dividends then there will be no change in the net position of the shareholder if there is no corporate income tax. But if there is a

Jensen and Meckling, that if the manager also puts at least some weight on his own interest (as distinct from that of shareholders) that independence of finance and investment decisions again fails. In the most standard interpretation, the manager is the agent and the shareholders are the principal. Greater debt will give the manager more control over resources, and therefore benefits the manager. Typically since higher investment increases the control of the manager, relative to shareholders, we would expect that firms with greater debt to make more internal investments. But this argument does not depend upon the manager acting only in his own best interest. The managers' preferences may also reflect their views as how they *should* behave as manager. Typically we would expect such a view to lead to preferences for inside, rather than financial. investment. Indeed we can conceive of a good manager whose job conception is that it is his duty as the manager of the firm actively to manage the firm's assets. In addition to the usual agency this is also consistent with Jensen and Meckling's views that debt-equity ratios will matter in the firm's debt decision. Indeed a recent sociological literature on the rise of CFO's describes an increased emphasis over the past 30 years in favor of *financial* management (Zorn (2004), Fligstein (1990)).

At least two striking studies suggest strongly the validity of the Jensen-Meckling argument. Blanchard, Lopez-de-Silanes and Shleifer (1994) explored the investment decisions of 11 firms that were favored with large legal settlements. They found that these firms had surprisingly high investment given their relatively low  $q$  ratio. In similar vein, Owen Lamont (1996) found that subsidiaries of oil companies with high windfall profits in the 1980s made greater investments

---

corporate income tax (and if earnings are paid out as dividends) the increase in debt will result in a net gain. The role of asymmetric information in causing greater investment by firms with  $f$ =greater liquidity has been empirically explored by Fazzari, Hubbard, and Petersen (1988) following the model by Myers and Majluf (1984).

than non-oil subsidiaries in the same industry. These findings suggest that managers' pursuit of their own goals negates Miller-Modigliani investment neutrality. The findings are consistent with the view that managers act in their own self-interest, rather than of their shareholders. But it is also consistent with the view that managers' decisions depend upon how they think that they should or should not behave. Neither of these findings are likely to be explained either by the role of taxes or the argument that higher debt-equity ratios signal knowledge of poor firm opportunities.

Again Waldo has appeared in the mis-characterization of an objective function. In this case the neutrality result depends upon managers' maximization of firm profits, rather than an objective function that takes into account their own interests, or their view of proper management, if that differs from maximization of shareholder value.

#### **IV. Wages and Prices**

The neutrality results for investment and consumption almost surely derive more from what they reveal about economic thinking than from their direct practical application. In both cases these results only hold under restrictive assumptions that most observers concede as highly unrealistic. On the other hand, a series of nested neutrality results regarding wage and price setting are at the core of modern macroeconomics. These nested results are quantity theories of money, natural rate theories, and rational expectations theories.

*Quantity Theory of Money.* The logic of the quantity theory of money is remarkably similar to that of Ricardian equivalence and Modigliani-Miller. They both reflect the ability of the public to exactly undo the actions of an overambitious bureaucrat. In Ricardian equivalence fiscal

authority changes the division of debt between public and private. The public exactly undoes the effect. In Miller-Modigliani, a bureaucratic firm manager changes the debt-equity ratio of the firm, but the public exactly offsets in the debt holdings in its own portfolio. There is no change in the real economic equilibrium. A similar reaction occurs in the quantity theory of money. Insofar as the monetary authority changes the quantity of money, presumably to control the level of aggregate demand, the public changes prices and wages in the exact same proportion, totally undoing any real effect of the change in the supply of money.

Patinkin (1957) derived an elegant neutrality proposition in the context of a general equilibrium model with markets for many goods and for many grades of labor; an increase in the money supply by a given percentage will be associated with a new equilibrium that differs from the old in only one fashion. Any equilibrium vector of wages and prices with the old money supply will be associated with a new equilibrium vector of equilibrium wages and prices with the new money supply. The wages and prices in the new equilibrium will differ from their old values by exactly the same percentage as the change in the money supply. In such a new equilibrium, since real demands and supplies for all goods and services depend only on relative prices, and all relative prices are unchanged, there will be no change in any equilibrium trade of any good or any service. If all markets cleared in the old equilibrium, then all markets will again clear in the new equilibrium. Since supplies and demands for all goods and factors depend only on relative prices and real balances, there will be no change whatsoever in any real variable between the old equilibrium and the new.

The neutrality of money, like most Modigliani-Miller propositions, is surprisingly general. It also generalizes beyond perfect competition to models where demanders and/or suppliers of

goods and factors have market power. But the proposition does depend on the nature of the utility function of both demanders and suppliers. Patinkin's demand and supply functions allow no role for mental frames where individuals have views regarding what they think prices and wages *should be* and their losses in utility insofar as prices and wages depart from those relations.

The existence of such a mental frame turns out to be implicit in the standard textbook *mantra* regarding the three purposes of money: *store of value*, *medium of exchange*, and *unit of account*.<sup>6</sup> Current modeling of money pays attention to its use as *store of value*, hence the role of real balances; it also pays attention to its use as a *medium of exchange*, hence the importance of transactions in most models of money demand. But I do not know of any model where its role as a *unit of account* has been explicitly modeled or had any real implications. But if money is used as a unit of account its users will in all likelihood have views as to how much money they think that they *should*, respectively, pay or receive for goods. Furthermore, the use of money as a unit of account entails that employees will also have a view as to how much they should receive in wages or salaries, and managers will, similarly, have a view regarding how much they think they should pay. Such views cause a difference that money is used as a *unit of account*.

Of course, in such models, if people's views as to what they should pay depends only on the relative prices of other goods, then monetary neutrality will continue to hold. While an economist can explain why "rational" human beings ought to form their mental frames in such a way, such behavior is not in any way necessary. But neutrality will not hold if people think that there is also there is a nominal component to the wages and prices that people think that they should pay or should receive.

---

<sup>6</sup>See, for example, Blanchard (2000).

It turns out that there is firm evidence of a nominal component to people's mental frames of prices and wages: wage and price stickiness. Wage stickiness, it turns out is, one of the best documented and most universal phenomena of modern economies. Studies have documented its existence in the United States, Canada, New Zealand, New Zealand, Australia, Mexico, Japan, Switzerland, Germany, and the United Kingdom<sup>7</sup>; studies of the United States have also documented its importance in past recessions.<sup>8</sup> It is also easy to explain nominal rigidity by adding a *V*-component to the utility function of employees, or employers. One need only add that the employees think that wage and salary cuts should not be given, and/or the employers think that wage/salary cuts should not be taken. In addition to people having a standard utility function for the goods and services they receive, they also have a view as to what they ought to be paid, which gives them disutility insofar as they are paid less. This addition to their utility function gives a kink at their current wage, and zero wage changes are an accumulation point in wage-change distributions.

Although less work has been done on price changes, they also have similar accumulation points at zero. Carlton (1986) has shown that prices are often sticky for significant periods of time, as has been also shown by Blinder *et al* (1998), who have also asked those involved in price

---

<sup>7</sup>The following studies have all found significant signs of nominal wage rigidity: Bewley (1999), Card and Hyslop (1997), Kahn (1997), Lebow, Saks and Wilson (1999), and Altonji and Devereux (1999) for the United States, by Fortin (1996) for Canada, by Cassino (1995) and Chapple (1996) for New Zealand, by Dwyer and Leong (2000) for Australia, by Castellanos *et al* (2003) for Mexico, by Kuroda and Yamamoto (2003a, 2003b, 2003c) and Kimura and Ueda (2001) for Japan, by Fehr and Goette (2003) for Switzerland, by Bauer *et al.* (2003) and Knoppik and Beissinger (2003) for Germany, by Nickell and Quintini (2001) (for the United Kingdom, and by Agell and Lundborg (2003) for Sweden.

<sup>8</sup>See, for example, O'Brien (1989) and Hanes (2000).

setting why they do not change them more often. Alan Kackmeister (2002) has compared data on the frequency of price change of individual commodities as sampled over a 28 month period between June 1889 to September 1991, and for a comparable period between June 1997 to September 1999. In the 19<sup>th</sup> century sample, before the supermarket and the automobile, when customer-dealer relations were much more personal, price changes were infrequent. The individual items would have an average spell between price changes of approximately 80 months.<sup>9</sup> Such remarkable lack of change of prices for individual items is consistent with our theory that these consumers might have a notion of the price that they *ought* to pay at stores where they are continued and knowing customers. They would resent price increases and store-owners would therefore be reluctant to change them, Kackmeister suggests that the decline in long-term customer relationships is one factor responsible for greater frequency of price change today (Kackmeister, 2003, pp. 59-63).

Wage, and also price, rigidity may have implications significantly beyond the importance of these phenomena in their own right, which is the unwillingness of workers to take wage cuts and the stickiness, both upward and downward of nominal prices. Both of these phenomena are tell-tales that people have a mental frame as to what wage they *should* receive or what price they *should* pay, and that these mental frames have a nominal—not just real—components. The clearest manifestation of such a nominal component of such a mental frame would be rigid wages and

---

<sup>9</sup>I derive this result from Kackmeister's data in the following way. He finds that in the 19<sup>th</sup> century that only 5 percent of items changed their prices per month. This means that the average spell of constant prices would have been 20 months (the inverse). But that is a biased statistic for the average length of time between price changes for an item on the shelf. Results from Akerlof and Clark and Summers regarding the difference between the average spell of employment or unemployment and the average spell being experienced by an individual suggests a rule of thumb ratio for four to one. Using this ratio as a rule of thumb suggests that the spell between price changes averaged over the individual items on the shelf would be 80 months.

prices. But it would be a very special case indeed if that is the sole nominal component in people's mental frame.

Formally, once again, as in the case of Ricardian equivalence and investment such behavior can be modeled by adding a component  $V$  to price setters'/takers' or wage setters'/takers' utility function which corresponds to paying prices that are different from what they think prices *should be*. Indeed, our theory can be viewed as an application of the generalized theory of reference points by Rabin and Köszegi (2004). Rabin and Köszegi say that consumers suffer a loss in utility insofar as they pay more for a good than their reference price, which is what they expect to pay for a good. Following Pareto once again, I characterize the customer's motives somewhat differently. I view her as losing utility insofar as she pays more than she thinks she *should* pay for it. Of course this same concept is even more naturally applied to labor and wages than to goods and prices. The wage earner is likely to take utility losses if she takes a wage that is less than she thinks that she deserves, and the manager takes a loss insofar as she pays a wage that is higher than what she thinks the employee deserves. But what is most important for macroeconomics is that these mental frames regarding the reference prices and wages may be in nominal, and not in real terms.

The questionnaire study by Shafir, Diamond and Tversky (1997) gives evidence that wage earners indeed do have such nominal framing. They asked respondents to comment on a vignette about two young women who take their first jobs with the same initial income. Specifically they asked respondents who will be better off, Barbara, who receives a four percent raise in the presence of five percent inflation, or Ann, who receives a two percent raise when inflation is zero. 79 percent of respondents said that Barbara would be worse off than Ann economically;

nevertheless, 64 percent of respondents thought that she would be happier. These findings can easily be explained by a purely utilitarian utility function. But they can be explained easily if Ann and Barbara both have an added  $V$  component to their utility functions that reflects the difference between the wage increases they think they *should* receive and the wage increases they actually do receive. In the absence of such an additional component it is difficult to perceive why Barbara, who is worse off economically, would also be happier.

Shiller (1997) gives remarkable corroborative evidence of such an additional component to employees' utility. In his study 49 percent of a sample of the general public either fully or weakly agreed with the statement that "if my pay went up I would feel more satisfaction in my job, more sense of fulfillment, even if prices went up as much." An additional 11 percent were uncertain. Only 27 percent completely disagreed. Pointedly economists responded very differently. 90 percent weakly or strongly disagreed with the statement, with 77 percent in complete disagreement.<sup>10</sup>

This question was just one in Shiller's study that indicated very large differences between the mental frames of economists and the general public. These differences suggest that if economists model the public behavior according to their own conception of utility they will have the potential for considerable error. They will have forgotten about the non-utilitarian aspects of individuals' mental frames. Such differences confirm the central point of this lecture.

A set of experiments by Fehr and Tyran (2001) further strengthens our view of the importance of nominal framing. Following many simple quantity theory models (Akerlof and Yellen (1985), Ball and Romer (1989), Blanchard and Kiyotaki (1987)) the payoff of each

---

<sup>10</sup>Shiller (1997, p. 37).

individual subject in each trial depended on the price he chose, the average price chosen by other subjects, and the money supply. A equi-proportionate change of all prices and the money supply would result in no change in the real payoffs, so that the equilibrium is money-neutral. After a number of initial trials in each individual experiment, the quantity of money changed. Fehr and Tyran found that the approach to the new equilibria after the change in the money supply differed according to whether payoffs were denoted in real or in nominal terms. Money illusion complicated the approach to the new equilibria not just because individual subjects themselves might have money illusion, but especially because they might impute it to others. More than half of their subjects thought that others would interpret high nominal payoffs as indicators of high real payoffs. The study shows not only the role of nominal framing in determining the nature of equilibria, but that small amounts of nominal framing, even if imputed to others, can result in significant violations of money neutrality.

*Natural Rate Theory.* This takes us in progression to the most influential neutrality result in macroeconomics, natural rate theory. According to natural rate theory, price setters and wage setters first figure out the prices and wages that they wish to set relative to other prices and/or wages (their real wage or price). Nominal prices and wages for the next period are then set by adjusting for expected inflation. The greater is the level of aggregate demand the higher will be the price that producers wish to set for their own product relative to the general price level. Such pricing contributes two components to inflation. The actual rate of inflation is the sum of two terms: inflationary expectations and the excess of the desired relative price over unity. Aggregate demand where the desired relative price is exactly one is then where actual and expected inflation are equal; and the unemployment rate at that level of aggregate demand is called the natural rate of

unemployment. With adaptive expectations, if unemployment is lower than the natural rate, inflation will always exceed expected inflation. As people adjust their expectations for past inflation and then add it into wage bargains and price-setting, inflation will be ever increasing. Similarly, with adaptive expectations, when unemployment is above the natural rate there will be ever decreasing inflation.

The natural rate story about wage and price setting is clear about the mental frame of the wage and price setters and wage and price takers. They only care about *relative (real)* prices and wages. In the description I have given of the price/wage setting process, there is no allowance for the possibility that the utility of either wage/price setters or wage/price takers depends upon what they think wages and/or prices should be and there is a nominal component to that. But respondents have suggested that Ann and Barbara have exactly such a utility function, and Shiller's sample of the general public indicates that they think that they also have such a utility function.

The insertion of such concerns into a utility function will give a long-term trade-off between employment and inflation, even in the most reductionist model. Assume a competitive labor market and firms with a concave production function with capital fixed. We now introduce a simple *V*-function with a small nominal component into employees' utility. Suppose that members of the public have idiosyncratic reservation utilities for staying at home, and that they get increasing utility from the real wages that they earn, but also, like Ann and Barbara, they get more utility from getting higher nominal wage increases. The fixed production function leads to a demand for labor that is downward sloping in the real wage rate. At a given rate of inflation the labor-leisure choice leads to an upward-sloping labor supply as a function of the real wage. With

employment at the levels where the two curves cross, inflation will be exactly stable. Higher inflation will shift the labor supply curve outward, and at that stable level of inflation the equilibrium level of employment and output will be higher. There will be a long-run trade-off between inflation and unemployment. This reductionist model shows how a nominal frame in which people care about the raises that they receive is just one assumption that, contrary to natural rate theory, will lead to a long-run trade-off between inflation and employment. Less reductionist, more realistic models, for example with efficiency wages and involuntary unemployment, will generate similar results.

Where does natural rate theory fail in this model? In a natural rate model in which Barbara and Ann get utility from raises, they should care about their raise not in nominal terms but relative to the expected rate of inflation. *A priori*, and especially at low inflation, it seems just as plausible, if not more so, that their mental frames will have such nominal dependence, rather than real dependence.

It is not difficult at all to generate further models in which a small amount of nominal framing will generate significant trade-offs between inflation and aggregate demand. To illustrate, a very simple natural model, only involving prices, will generate a significant long-run trade-off between inflation and unemployment. We consider the standard model in which aggregate demand depends only on real balances but the demand for any individual firm depends upon the price of its product relative to the average price level as a whole. Suppose that customers pay attention to nominal price changes: such change catches their attention. So the faster the price of a good changes, the more customers search for alternative suppliers. (We can think of this increased

search as the result customers' belief that the price of the goods they buy *should* not change.<sup>11</sup> We can view them as having a *V*-function). In the simplest model, increased search increases the elasticity of demand for each individual good. In response to this customer behavior, firms will try to keep down their price relative to the price being charged by their competitors. Such behavior will increase the level of aggregate demand at which the price the individual firm wants to charge relative to the aggregate price level is unity, and thus higher stable levels of inflation will be associated with higher levels of aggregate demand.

The violation of money illusion occurs here because the truly rational consumer would intensify her search for alternative products only if the rate of change of the price of her product increased faster than the rate of change of the price of other products. Is it more realistic to assume that the willingness of the consumer to shift depends on the change in the expected relative price rather than on the change in the nominal price.<sup>12</sup> Current macroeconomics textbooks' almost uniform endorsement of natural rate theory would indicate that everyone knows that the answer to this question is *yes*.<sup>13</sup> But there is a good argument on the other side. The use of money as a *unit of account* makes nominal frames very natural at low and moderate rates of inflation.

---

<sup>11</sup>Just consider the standard model of Romer's peasant farmers in which the elasticity of the farmers for purchase of the substitute goods of production is increases with the rate of change of those goods. The same principal will apply in a model in the form of Akerlof and Yellen or Blanchard and Kiyotaki. Such a model will produce a significant trade-off between inflation and aggregate output.

<sup>12</sup>The model by Iwai (1981) and Caplin and Leahy (1991) also produces an inflation-aggregate demand tradeoff. Nominal framing occurs in their model because price setters (wage setters) pay a fixed fee (a fixed "menu cost") to change a nominal price (or nominal wage). If, instead, there were such a fixed fee to change the real price (or real wage), money neutrality would be preserved. Their model provides another model of the fragility of natural rate theory.

<sup>13</sup>As just one example of such textbook endorsement, see Mankiw (1997).

Once again we have seen the Waldo that generates the neutrality result. Once again Waldo consists of a framework in which utilitarian considerations alone dictate utility maximization. There is no scope at all in these models for a utility framework in which buyers and sellers of goods or factors of production have ideas about how nominal prices or wages should or should not behave.

In my opinion then natural rate theory has wrongly held in check the imagination of macroeconomists. It has limited economists' imagination empirically, as they have accepted natural rate theory, because their tests fail to reject it, all the while ignoring the extremely low power of these same tests against alternative models with some nominal framing and very significant trade-offs between inflation and unemployment. But natural rate theory has limited economists' theoretical imaginations as well. Such an expansion of our imaginations should not just be applied to low inflation, since it is possible also to imagine non-neutral frames that accompany high inflation.

Indeed there are likely to be many situations in which inflation becomes so salient that people over-react to inflation in their setting of prices and wages. In this case the long-run Phillips curve will be backward bending. The combination of overreaction to inflation and under-reaction to it gives a good goal for optimal economic policy: those levels of inflation with negative and with positive long-run trade-offs between inflation and unemployment cannot be optimal. The usual model of credibility uses a natural rate or a rational expectations model in which people have the rational long-term or short-term reaction to a money supply rule. Barro and Gordon (1983) and Rogoff (1987) use such a model with rational expectations to justify policies of low inflation. But they may have sold credibility short: it may be even more important in the presence of

overreaction than in the presence of rational expectations. The exploration of such areas has been unfortunately shut off by macroeconomists' concentration on models without overreactions.

*Rational Expectations Theory.* The rational expectations theory of Robert Lucas and Thomas Sargent takes natural rate theory one step further, with a yet more dramatic neutrality result. Following Lucas and Sargent, in an economy with a natural rate and also with rational expectations, no money supply rule can stabilize the economy, because price setters and wage setters take actions that exactly offset the effects of the money supply rule.

Macroeconomists may be divided on whether they think that rational expectations gives a good description of expectations formation, but they have been undivided on their surprise at the results of Lucas and Sargent, which seemed to say that even a small deviation in macroeconomic thinking, from the assumption of, let us say, adaptive expectations to rational expectations, would make monetary policy completely ineffective. It would be ineffective not only in keeping unemployment permanently low, as in natural rate theory; it would also be ineffective in *stabilizing* output and employment.

But once again I am conjecturing that Keynesian macroeconomists have not understood the relation between formal modeling and their own intuitions. The key assumption by Lucas and Sargent is not rational expectations, but rather it is the nature of the price and wage setting of the economic system. If there is a nominal component to the mental framing involved in setting wages and prices, then monetary policy will, in ordinary circumstances be stabilizing, whether there is rational expectations or not. In this sense the ability of monetary policy to stabilize output and employment does not just depend upon the detailed specification of expectations formation, rather it comes from the more basic assumptions that led to a natural rate economy.

## V. Relation to Economic Methodology

Of course there is systematic reason why macroeconomics, and also economics more generally, should have missed, the importance of mental framing. The standard positive-economics methodology of theoretical and empirical economics is highly inimical to such considerations. Following Friedman's essay, "The Methodology of Positive Economics," economic theorists should strive for parsimonious modeling. Indeed, according to Friedman, they should even forsake realistic assumptions in pursuit of such parsimony. Maximization models with only *objective* arguments of utility (with only U functions and no V functions) are more parsimonious than models with mental framing. In consequence, whatever the empirical validity or relevance of non-utilitarian mental frames may be, positive economics has a methodological bias against such theory.

But positive economics is not only contrary to a naturalistic approach to *theory*, it is also in exact opposition to a naturalistic approach to *empirical observation* as well. Friedman says that economists should not pay heed to the stated intentions of decision makers. Instead their empirical work should only test hypotheses suggested by their parsimonious models of behavior. In contrast, in a more naturalistic approach economists would observe decision-makers as closely as possible, with the express intent of characterizing their mental frames, and using these mental frames as the basis for modeling of economic structure. Indeed sociological and anthropological ethnographers do precisely that: they depict their subjects' motivation from close observation.

If economic tests had great power, then it would be easy of course to follow Friedman's dictum of making more and more refined tests of hypotheses with decreasing parsimony. With such power, in due course, this method might get to models where mental frames affect decision-

making, if that is how people really do behave. But even the most parsimonious economic models are very imprecise in their specification of the independent variable, the nature of the dependent variables, the nature of leads and lags, and the nature of residuals. Yet worse, almost any economic problem usually involves simultaneity (as in supply and demand), making establishment of causality usually extremely difficult. In almost any instance a very large number of parsimonious models can be fitted statistically, making it hard—if not all but impossible—to statistically reject all the variants of models without mental frames. As a result the program of positive economics, with its call for parsimonious models, which have only with rational behavior and which are verified only by statistical hypothesis testing, has an extreme bias against explanations of economic phenomena where mental frames play a role. There is almost always some rational hypothesis, no matter how implausible, which takes precedence in this methodology because all variants of it are too hard to reject.

But such a methodology fails to appreciate that careful observation of the small in other disciplines has very often proved to be the key to the understanding of the large. To me, the most dramatic example of such a relation between the small and the large occurs in the structure of life itself. Crick and Watson<sup>14</sup> conjectured correctly that if they could describe the crystalline structure of a single DNA molecule they would have unlocked the secret of life. The duality between the structure of the DNA molecule and the way in which organisms are generated and reproduced is one of most beautiful findings of human knowledge. It indicates the sense in which Crick and Watson were, indeed, profoundly correct.

But what are the implications for social science? Positive economics, with its emphasis on

---

<sup>14</sup>As dramatically described by Watson (1969).

statistical analysis of *populations*, would suggest that the intensive study of a single molecule would be an all but worthless “case study.” In the case of DNA, we know that the exact opposite is true: because DNA is a template that determines all of the cells of the organism, and also its reproduction, one molecule may not tell all, but it does tell a great deal.

Is there some reason to believe that economic behavior and economic units are any different? Economic decisions may not be as duplicable as biological processes, but the basic reason why science intensively studies the microscopic applies to economics as well. The individual economic unit, be it a firm, a consumer, or an employee, behaves the way it does *for a reason*. And if these actors behave as they do for a reason, we can expect to find those reasons from the structures that we see in close observation; and because of those structures their behavior will also tend to be duplicated. This duality between duplicability and structure explains why so very much science concerns very close observation, as it also explains why the study of even a single part of a single DNA molecule may be instructive.

Standard economic methodology says that it is impossible to infer motivation of individual actors from intensive case studies. But shouldn't this question be decided empirically, rather than *a priori*? Anthropologists and sociologists listen carefully to individuals in case studies because, as in a lie detector test, people find it hard to cover up the real reasons for their actions, even when they want to hide them. If that is the case, the best information on the behavior of populations probably comes from close observation of individual units, rather than from analysis of statistical populations.

The possible importance of mental frames and the bias against seeing their importance is then inherent in the standard methodology of economics. It is no coincidence that there are so few

studies, for example, of the nature of money illusion, despite its being the crucial assumption of macroeconomics. Since Kahneman and Tversky's exposition of prospect theory economists have been beginning to take mental frames seriously. This lecture has illustrated with the studies of Shafir, Diamond and Tversky (1997) and of Shiller (1997) as two examples. Bewley's (1999) seminal study also was an attempt to tease out the mental frames of wage setters by close observation. This lecture suggests that it is now time for a much more concerted attempt to observe mental frames that are inconsistent with the utilitarian decision-making that underlies the neutrality results of macroeconomics. Of course, it is also possible to devise laboratory tests of such neutrality. If it fails to hold in economics laboratories, it can hardly be expected to approximate reality in the real world, where situations are much more complicated and therefore much less transparent. Ideally such laboratory tests with neutrality failures should try to uncover subjects' motivations that are responsible for such failures.

## **VI. Conclusion**

The first and most obvious conclusion of this paper is that, as a description of reality, the neutrality results are suspect. They are suspect not just because there are frictions that keep them from being true, but rather because they are based on the wrong objective functions, that is the wrong human motivation. In this sense even in a world lacking in frictions, these neutrality results will still not be true. An essential feature generating each of the neutrality results is failure to take a realistic and expansive model of the protagonists' mental frame. Ignoring Pareto's *Compendium*, in each and every case there was no account taken of how these protagonists thought that they, and others, *should* or *should not* behave.

We have seen examples of such omission in the areas of consumption, investment, and wage and price-setting. I conjecture that the major neutrality results came as a surprise because the economists of the time failed to understand the limitations of utilitarian-based modeling, and that their own intuitions had been based on their own insights and observations as to how they thought people should or should not behave.

This new perspective on the foundations of macroeconomic behavior suggests at least slight modification of standard macroeconomic theory: the standard neutrality results should be disregarded, except in cases where the decision-makers are uninfluenced by a mental frame which tells them how they *ought* to behave. It is not clear that these neutrality propositions are very useful to macroeconomics in any case, beyond giving the field a misplaced pretense to precision. Since one of the components of decision makers' objective function is the standard real effects, the difference between comparative statics between models with and without mental framing will be undisturbed with regard to sign. The major difference between the effects of standard economic arguments in the two types of models will be the precision of the theoretical predictions. For example, Keynes' discussion of his consumption function, where (1936, pp. 94-5) he mentions the effects of changes in fiscal policy and the effects of changes in expectations of the relation between the present and the future level of income future taxation, suggests that the current generation will reduce its consumption from social security out of concern for their heirs. Ricardian equivalence of course makes the same prediction, but additionally also says that this change due to the expected higher future taxes will exactly offset the rise because of larger current after tax income. The part of the argument that fails is the strong prediction that for consumers who are leaving bequests that consumption should be exactly offsetting.

Abandonment of macroeconomic neutrality results may not have much consequence for macroeconomists in the area of consumption and investment, since such failure also occurs for many other reasons which are obvious, and, in the case of investment because a  $V$ -component to managers' objective function has already been recognized.

But abandonment of natural rate theory has many important consequences. Macroeconomic policy in the United States, Canada, and in Western Europe demonstrate the potential of such theory to influence macroeconomic policy. A first example comes from the United States, where Federal Reserve staff uses natural rate models to forecast employment and inflation. In late spring of 1996, their models were forecasting that if unemployment fell significantly below 6 percent (the models' approximate NAIRU) inflation would take off. But Alan Greenspan (Woodward (2000)) saw no indications that inflation was about to rise and persuaded the FOMC not to raise interest rates. But they went along reluctantly, because they too were also restive about unemployment below the presumed NAIRU. If the adherents of natural rate theory had prevailed the US economic prosperity of the late 1990s might have never happened.

The other side of the border provides a demonstration of the opposite experience in the same period. Despite low inflation and high unemployment since the beginning of the 1990s, the Bank of Canada maintained a remarkably tight monetary policy until almost 2000 (Fortin *et al* (2000)). Natural rate theory suggested that the harm from such restrictive policy would be minimal. The high unemployment might be felt at the time that it occurred, but the economy would get a payback. To meet a fixed inflation target, it would allow for lower unemployment, almost one-for-one, later. However, it appears that natural rate theory was not correct as the expected deceleration in inflation never materialized. Between 1992 and 2000 the Canadian

unemployment rate averaged 9.3 percent, considerably above even conservative estimates of the natural rate, yet core inflation only declined by .1 percent of a point. (Fortin *et al.*, 2000, p. 7). It appears as if Canada paid a high price for an outmoded theory.

Certainly natural rate theory dominates macroeconomic thinking in Europe today. The EU has had continued high unemployment and also low inflation. Despite the costs of this policy, there has been remarkably little attempt to examine whether lower unemployment would be accompanied by accelerating inflation.

The possible effects of mental framing on macroeconomic variables should not just influence policy, but the research program of macroeconomists as well. Especially since neutrality results seem to be so dependent on such framing, it should be a research priority to see whether or not important economic decisions depend upon the mental frames. It is of special importance in the case of price setting and wage to ascertain the influence of forms of nominal anchoring.

But, in addition, to conclude, macroeconomics is itself a tell-tale for all economics, where the role of mental framing is sure to prove much more important for a wide number of decisions than has so far been appreciated.

## References

- Agell, Jonas and Per Lundborg, "Survey Evidence on Wage Rigidity and Unemployment: Sweden in the 1990s," *Scandinavian Journal of Economics*, 105:1 (March, 2003) pp. 15-29.
- Akerlof, George A., William T. Dickens, and George L. Perry, "The Macroeconomics of Low Inflation," *Brookings Papers on Economic Activity*, 1996:1, pp. 1-59.
- \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_, "Near-Rational Wage and Price Setting and the Long-Run Phillips Curve," *Brookings Papers on Economic Activity*, 2000:1, pp. 1-44.
- \_\_\_\_\_ and Rachel E. Kranton, "Economics and Identity," *The Quarterly Journal of Economics*, Vol. 115, No. 3. (Aug., 2000), pp. 715-753.
- \_\_\_\_\_, and Rachel E. Kranton, "The Economics of Organizations," mimeo, Berkeley, CA, September, 2003.
- \_\_\_\_\_, and \_\_\_\_\_, "Identity and Schooling: Some Lessons for the Economics of Education," *Journal of Economic Literature* 40:4, December 2002, pp. 1167-1201.
- \_\_\_\_\_, and Janet L. Yellen, "A Near-Rational Model of the Business Cycle, with Wage and Price Inertia," *The Quarterly Journal of Economics*, Vol. 100, Supplement. (1985), pp. 823-838.
- Altonji, Joseph G., and Paul J. Devereux, "The Extent and Consequences of Downward Nominal Wage Rigidity," NBER Working Paper No. 7236, Cambridge, MA, July 1999.
- Ball, Laurence and David Romer, "Are Prices too Sticky?" *Quarterly Journal of Economics*, 104:3, (Aug., 1989), pp. 507-524.
- Barro, Robert J., "Are Government Bonds Net Wealth?" *Journal of Political Economy*, 82:6, (November, 1974), pp. 1095-1117.
- \_\_\_\_\_, "The Ricardian Approach to Budget Deficits," *Journal of Economic Perspectives*, 3: 2. (Spring, 1989), pp. 37-54.
- \_\_\_\_\_, and David B. Gordon, "A Positive Theory of Monetary Policy in a Natural Rate Model," *Journal of Political Economy*, 91:4, (August 1983), pp. 589-610.

- Bauer, Thomas, Holger Bonin, and Uwe Sunde, "Real and Nominal Wage Rigidities and the Rate of Inflation: Evidence from German Micro Data," Institute for the Study of Labor, Discussion Paper No. 959, December 2003.
- Benedict, Ruth, *The Chrysanthemum and the Sword*. Boston: Houghton-Mifflin, 1946.
- Bernheim, B. Douglas, and Kyle Bagwell, "Is Everything Neutral?" *Journal of Political Economy*, 96: 2, (Apr., 1988), pp. 308-338.
- Bewley, Truman, *Why Wages Don't Fall During a Recession*. Cambridge, MA: Harvard University Press, 1999.
- Blanchard, Olivier J., and Kiyotaki, Nobuhiro. "Monopolistic Competition and the Effects of Aggregate Demand." *American Economic Review* September, 1987, 77(4), pp. 647-66.
- \_\_\_\_\_, Florencio Lopez-de-Silanes, and Andrew Shleifer, "What Do Firms Do with Cash Windfalls," *Journal of Financial Economics*, 36:3, (December, 1994), pp. 337-360.
- \_\_\_\_\_, *Macroeconomics*, Second Edition. Saddle River, NJ: Prentice-Hall, 2000.
- Blinder, Alan S., and Don Choi, "A Shred of Evidence on Theories of Wage Stickiness," *Quarterly Journal of Economics*, 105:4, (November 1990), pp. 1003-15.
- \_\_\_\_\_, Elie R. D. Canetti, David E. Lebow, and Jeremy B. Rudd, *Asking About Prices: A new Approach to Understanding Wage Stickiness*. New York: Russell Sage Foundation, 1998.
- Caplin, Andrew S., and John Leahy, "State-Dependent Pricing and the Dynamics of Money and Output," *The Quarterly Journal of Economics*, Vol. 106, No. 3. (Aug., 1991), pp. 683-708.
- Card, David, and Dean Hyslop, "Does Inflation Grease the Wheels of the Labor Market?" pp. 71-114 in *Reducing Inflation: Motivation and Strategy*, Christina D. Romer and David H. Romer, eds. Chicago: University of Chicago Press, 1997.
- Carlton, Dennis W., "The Rigidity of Prices," *American Economic Review*, 76: 4 (Sep., 1986), pp. 637-658.
- Castellanos, Sara G., Rodrigo García-Verdú and David Kaplan, "Wage Rigidities in Mexico: Evidence from Social Security Records," NBER Working Paper 10383, Cambridge, MA, March 2004.
- Cassino, Vincenzo, "The Distribution of Wage and Price Changes in New Zealand," Reserve

- Bank of New Zealand Discussion Paper No G95/6, 1995.
- Chapple, Simon, "Money Wage Rigidity in New Zealand," *Labour Market Bulletin*, 1996:2, pp. 23-50.
- Choi, James J., David Laibson and Brigitte C. Madrian, "Plan Design and 401(k) Outcomes," *National Tax Journal*, June 2004.
- Dwyer, Jacqueline and Kenneth Leong, "Nominal Wage Rigidity in Australia," Research Discussion Paper 2000-08, Reserve Bank of Australia, November, 2000.
- Fazzari, Steven M., R. Glenn Hubbard, and Bruce C. Petersen, "Financing Constraints and Corporate Investment," *Brookings Papers on Economic Activity*, 1988: 1, pp. 141-206.
- Fehr, Ernst, and Lorenz Goette, "Robustness and Real Consequences of Nominal Wage Rigidity," Working Paper No. 44, Institute for Empirical Research in Economics, University of Zurich, March 2003, (*Journal of Monetary Economics*, forthcoming).
- \_\_\_\_\_, and Jean-Robert Tyran, "Does Money Illusion Matter?" *American Economic Review*, 91:5, (December 2001), pp. 1239-1262.
- Feldstein, Martin S., "Social Security, Induced Retirement, and Aggregate Capital Accumulation," *Journal of Political Economy*, 82: 5, (Sep. - Oct., 1974), pp. 905-926.
- \_\_\_\_\_, and Anthony Pellechio, *he Review of Economics and Statistics*, "Social Security and Household Wealth Accumulation: New Microeconomic Evidence," 61:3. (Aug., 1979), pp. 361-368.
- Fisher, Irving, *The Money Illusion*. New York: Adelphi, 1928.
- Fligstein, Neil, *The Transformation of Corporate Control*. Cambridge, MA: Harvard University Press, 1990.
- Fortin, Pierre, George Akerlof, William T. Dickens and George L. Perry, "Inflation and Unemployment in the U.S. and Canada: A Common Framework", March 2002.
- Friedman, Milton, "The Methodology of Positive Economics," pp. 3-43 in Milton Friedman, *Essays in Positive Economics*. Chicago: University of Chicago Press, 1953.
- \_\_\_\_\_, *A Theory of the Consumption Function*. Princeton, NJ: Princeton University Press, 1957.
- \_\_\_\_\_. "The Role of Monetary Policy." *American Economic Review*, March 1968, 58(1), pp. 1-17.

- Groshen, Erica L., and Mark E. Schweitzer, "Identifying Inflation's Grease and Sand Effects in the Labor Market," pp. 273-308 in *The Costs and Benefits of Price Stability*, Martin Feldstein, ed. Chicago: University of Chicago Press, 1997.
- Homans, George C., *The Human Group*. London: Routledge and Kegan Paul, 1951.
- Iwai, Katsuhito, *Disequilibrium Dynamics: A Theoretical Analysis of Inflation and Unemployment*. New Haven: Yale University Press, 1981.
- Jensen, Michael C., and William H. Meckling, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics*, 3:4 (October 1976), pp.305-360.
- Kackmesiter, Alan K., "Has Retail Price Behavior Changed Since 1889? Evidence from Micro Data," Ph.D. Thesis, University of California, Berkeley, 2002.
- Kahn, Shulamit, "Evidence of Nominal Wage Stickiness from Micro-data," *American Economic Review*, 87:5, (December 1997), pp. 993-1008.
- Kahneman, Daniel and Tversky, Amos. "Prospect Theory: An Analysis of Decision under Risk." *Econometrica*, March 1979, 47(2), pp. 263-92.
- Keynes, John Maynard. *The General Theory of Employment, Interest and Money*. New York: Macmillan, 1936.
- Kimura, Takeshi, and Kazuo Ueda, "Downward Nominal Wage Rigidity in Japan," *Journal of the Japanese and International Economies*, 15, 2001, pp. 50-67.
- Knoppik, Christoph, and Thomas Beissinger, "How Rigid Are Nominal Wages? Evidence and Implications for Germany," *Scandinavian Journal of Economics*, 105:4, (December 2003), pp. 619-41.
- Krusell, Per and Anthony Smith, "Revisiting the Welfare Effects of Eliminating Business Cycles" Discussion Paper, Carnegie Mellon University, November 2002.
- Kuroda, Sachiko and Isamu Yamamoto, "Are Japanese Nominal Wages Downwardly Rigid? (Part I): Examinations of Nominal Wage Change Distributions," Institute for Monetary and Economic Studies, Bank of Japan, *Monetary and Economic Studies*, 21:2, (August 2003a), pp. 1-29.
- Kuroda, Sachiko and Isamu Yamamoto, "Are Japanese Nominal Wages Downwardly Rigid? (Part II): Examinations using a Friction Model," ), Institute for Monetary and Economic Studies, Bank of Japan, *Monetary and Economic Studies*, 21:2, (August 2003b), pp. 31-68.

- Kuroda, Sachiko and Isamu Yamamoto, "The Impact of Downward Nominal Wage Rigidity on the Unemployment Rate: Quantitative Evidence from Japan," Institute for Monetary and Economic Studies, Bank of Japan, *Monetary and Economic Studies*, 21:4, (December 2003c), pp. 57-86.
- Lamont, Owen, "Cash Flow and Investment: Evidence from Internal Capital Markets," *Journal of Finance*,. 52:1, (Mar., 1997), pp. 83-109.
- Lebow, David E., Raven E. Saks, and Beth Anne Wilson, "Downward Nominal Wage Rigidity: Evidence from the Employment Cost Index." Board of Governors of the Federal Reserve System, Finance and Economics Discussion Paper no. 99-31, July, 1999.
- Lucas, Robert E., Jr., "Expectations and the Neutrality of Money," *Journal of Economic Theory*, 4:2 (April, 1972), pp. 103-124.
- Lucas, Robert E., Jr. and Thomas J. Sargent, "After Keynesian Macroeconomics," in *After the Phillips Curve: Persistence of High Inflation and Unemployment*. Federal Reserve Bank of Boston Conference No. 19, 1979.
- Lundborg, Per and Hans Sacklén, "Is There a Long-Run Unemployment-Inflation Trade-off in Sweden?" FIEF Working Paper 173, Stockholm, May, 2003.
- Madrian, Brigitte C. and Shea, Dennis F. "The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior." *Quarterly Journal of Economics*, November 2001, 116(4), pp. 1149-87.
- Mankiw, N. Gregory, *Macroeconomics*. New York: Worth Publishers, 1997.
- Meyer, John R. and Edwin Kuh, *The Investment Decision: An Empirical Study*. Cambridge, MA: Harvard University Press, 1957.
- Modigliani, Franco, and Richard Brumberg, "Utility Analysis and the Consumption Function: An Interpretation of Cross-Section Data." In Kenneth K. Kurihara, ed., *Post-Keynesian Economics*, pp. 388-436. New Brunswick, NJ: Rutgers University Press.
- Modigliani, Franco, and Merton H. Miller, "The Cost of Capital, Corporation Finance and the Theory of Investment," *American Economic Review*, 48: 3, (Jun., 1958), pp. 261-297.
- Myers, Stewart C. and Nicholas S. Majluf, "Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have," *Journal of Financial Economics*, 13:2 (June 1984), pp. 187-221.

- Nickell, Stephen and Glenda Quintini, "Nominal Wage Rigidity and the Rate of Inflation," Center for Economic Performance, London School of Economics, March 2001.
- O'Brien, Anthony P., "A Behavioral Explanation for Nominal Wage Rigidity During the Great Depression," *Quarterly Journal of Economics*, 104:4 (November, 1989), pp. 719-735.
- Pareto, Vilfredo, *Compendium of General Sociology*, Abridged in Italian by Giulio Farina, 1920 from *Trattato di Sociologia Generale*. Translated by Elisabeth Abbott. Minneapolis, MN: University of Minnesota Press, 1980.
- Patinkin, Donald. *Money, Interest, and Prices: An Integration of Monetary and Value Theory*. Evanston, IL: Row, Peterson, 1956.
- Phelps, Edmund S., "Money-Wage Dynamics and Labor-Market Equilibrium," *Journal of Political Economy*, August, 1968, 76(4), Part 2, pp. 678-711.
- Rabin, Matthew, "Risk Aversion and Expected-Utility Theory: A Calibration Theorem," *Econometrica*, 68,:5, (Sep., 2000), pp. 1281-1292.
- \_\_\_\_\_, and Botond Köszegi, "A Model of Reference-Dependent Preferences," mimeo, University of California, Berkeley, March 2004.
- Rogoff, Kenneth, "The Optimal Degree of Commitment to an Intermediate Monetary Target," *Quarterly Journal of Economics*, 100:4, (Nov., 1985), pp. 1169-1189.
- Sargent, Thomas J, "Rational Expectations, the Real Rate of Interest, and the Natural Rate of Unemployment," *Brookings Papers on Economic Activity*, 1973: 2, pp. 429-480.
- Seater John J., "Ricardian Equivalence," *Journal of Economic Literature*, 31: 1, (Mar., 1993), pp. 142-190.
- Shafir, Eldar, Peter Diamond, and Amos Tversky, "Money Illusion," *Quarterly Journal of Economics*, 112:2, (May 1997), pp. 341-74.
- Shiller, Robert J., "Why Do People Dislike Inflation?" pp. 13-65 in Christina Romer and David Romer, eds., *Reducing Inflation: Motivation and Strategy*. Chicago: University of Chicago Press, 1997.
- Staiger, Douglas, James Stock and Mark Watson, "How Precise Are Estimates of the Natural Rate of Unemployment?" in Christina D. Romer and David H. Romer (eds.) *Reducing Inflation: Motivation and Strategy* (Chicago, IL: University of Chicago Press), 1997, pp. 195-242.

- Stock, James H. and Mark W. Watson, "Has the Business Cycle Changed? Evidence and Explanations," *Proceedings of a Symposium on Monetary Policy and Uncertainty: Adapting to a Changing Economy*, Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, September 2003.
- Thaler, Richard H., and Benartzi, Shlomo, "Save More Tomorrow: Using Behavioral Economics to Increase Employee Saving." *Journal of Political Economy*, 112:1 Pt.2 (Feb. 2004), pp. S164-S187.
- Watson, James D., *The Double Helix: A Personal Account of the Discovery of the Structure of DNA*. New York: New American Library, 1969.
- Woodward, Bob, *Maestro: Greenspan's Fed and the American Boom*. New York: Simon and Schuster, 2000.
- Zorn, Dirk M., "Here a Chief, There a Chief: The Rise of the CFO," *American Sociological Review*, 69:3 (June 2004), pp. 345-64.