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1 SIGNAL OR NOISE? IMPLICATIONS OF THE TERM PREMIUM FOR RECESSION FORECASTING

Joshua V. Rosenberg and Samuel Maurer

Since the 1970s, an inverted yield curve has been a reliable signal of an imminent recession. One interpretation of this signal is that markets expect monetary policy to ease as the Federal Reserve responds to an upcoming deterioration in economic conditions. Some have argued that the yield curve inversion in August 2006 did not signal an imminent recession, but instead was triggered by an unusually low level of the term premium. This article examines whether changes in the term premium can distort the recession signal given by an inverted yield curve. The authors use the Kim and Wright (2005) decomposition of the term spread into an expectations component and a term premium component to compare recession forecasting models with and without the term premium. They find that the expectations component of the term spread is a leading indicator of recession, while the term premium component is not. Their analysis of recession forecasting performance provides some evidence that a model based on the expectations component is more accurate than the standard model that uses the term spread.

13 POVERTY IN NEW YORK CITY, 1969-99: THE INFLUENCE OF DEMOGRAPHIC CHANGE, INCOME GROWTH, AND INCOME INEQUALITY

Mark K. Levitan and Susan S. Wieler

The four-year rise in the U.S. poverty rate that began with the 2001 recession and the aftermath of Hurricane Katrina has sparked renewed interest in poverty among researchers and policymakers. Policies for addressing poverty are influenced by perceptions of its causes. Accordingly, this article evaluates the impact of several purported causes of poverty in New York City. Using decennial census data for 1970-2000, the authors employ simulations and a decomposition framework to investigate the relationship between poverty and key demographic and economic changes in the city. They find that two demographic changes—the growing percentage of the city’s black and Hispanic populations and the increasing share of residents living in female-headed families—are clearly associated with the city’s rise in poverty from 1969 to 1979 and the continued high poverty rate from 1979 to 1999. However, when these demographic changes are placed in the context of income growth and expanding income inequality, the study finds that the rise in income inequality plays a larger role in the 1979-99 persistence of poverty than do demographic changes. The authors also explore the influence of changes in earnings inequality on income inequality and poverty. They find a considerable increase in poverty and an expansion of earnings inequality within a key element of the city’s population: persons living in full-year working families. The rise in earnings inequality can be traced to the stagnation of wages at the low end of the earnings distribution.

31 WHY THE U.S. TREASURY BEGAN AUCTIONING TREASURY BILLS IN 1929

Kenneth D. Garbade

The U.S. Treasury began auctioning zero-coupon bills in 1929 to complement the fixed-price subscription offerings of coupon-bearing certificates of indebtedness, notes, and bonds that it had previously relied upon. Bills soon came to play a central role in Treasury cash and debt management. This article explains that the Treasury began auctioning bills to mitigate flaws in the structure of its financing operations that had become apparent during the 1920s. The flaws included the underpricing of new issues to limit the risk of a failed offering; borrowing in advance of actual requirements, resulting in negative carry on Treasury cash balances at commercial banks; and the redemption of maturing issues in advance of tax receipts, resulting in short-term borrowings from Federal Reserve Banks that sometimes led to transient fluctuations in reserves available to the banking system and undesirable volatility in overnight interest rates.

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SIGNAL OR NOISE? IMPLICATIONS OF THE TERM PREMIUM FOR RECESSION FORECASTING

- Since the 1970s, an inverted yield curve has been a reliable signal of an imminent recession.
- Some have argued that the yield curve inversion in August 2006 did not signal a recession because it was driven by an unusually low level of the term premium rather than by changes in interest rate expectations.
- If the predictive power of the yield curve signal comes from interest rate expectations, then a forecasting model that separates this component from the term premium may be more accurate than the standard model.
- A comparison of forecasting performance finds that a model without the term premium provided recession signals similar to those of the standard model since the 1970s, but recently the two models' signals have diverged.

1. INTRODUCTION

Ongoing efforts to find the best method for predicting recessions leave many questions unresolved. Existing papers propose a variety of indicators and modeling techniques, yet overall forecast accuracy has been mixed (see, for example, Stock and Watson [2003]). One approach with an excellent track record is the term spread model of Estrella and Hardouvelis (1991).¹ When the yield on a three-month Treasury bill rises higher than the yield on a ten-year Treasury note, the model forecasts that a recession will begin twelve months in the future.

Why should a negative term spread predict a recession? The expectations hypothesis posits that long-term interest rates are determined by expected future short-term rates. Because short-term rates are governed by monetary policy, investors should expect declines as a phase of monetary tightening transitions to monetary easing. As expected future short-term rates fall below current short-term rates, the yield curve inverts. Estrella and Adrian (2008) show that the yield-curve inversion that comes at the end of a tightening cycle has historically been followed by a decline in real activity, which provides a

¹ Estrella (2005c) observes that the relationship between the yield curve and economic conditions has been examined in papers going back to the early 1900s. In more recent work, Harvey (1988, 1989) focuses on consumption and GDP while Laurent (1988, 1989) analyzes GNP. The approach is developed further in Estrella and Mishkin (1998), Estrella (2005a, 2005b), and Estrella and Trubin (2006).

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compelling link between yield-curve inversion and an imminent recession.

However, a large body of literature (such as Dai and Singleton [2002]) shows that the expectations hypothesis does not provide a complete explanation of yield-curve behavior. In particular, yields also depend on the maturity of securities: Longer term Treasury securities are riskier and require a premium to compensate for this extra risk. These term premia vary over time as interest rate risk and investors' risk tolerance fluctuate.

Normally, the term premium provides a buffer that prevents minor variations in interest rate expectations from inverting the yield curve. But when the term premium is small and the

This article investigates whether changes in the term premium tend to distort the term spread's recession signals.

yield curve is relatively flat, this buffer disappears. Previous research does not find a strong link between low term premia and recessions (see, for instance, Hamilton and Kim [2002] and Rudebusch, Sack, and Swanson [2007]), so this occasional sensitivity to small changes in expectations may reduce the accuracy of recession forecasts.

In August 2006, the yield curve inverted and the Estrella and Hardouvelis (1991) model predicted that a recession would begin in August 2007.² This event drew renewed attention to the term spread recession forecasting approach. However, the term premium had also fallen to an unusually low level, which raised concerns that the observed yield-curve inversion might not in fact indicate an impending recession (see, for example, Dudley [2006]).

This article investigates whether changes in the term premium tend to distort the term spread's recession signals.³ We begin by decomposing the term spread into an expectations component and a term premium component, based on the Kim and Wright (2005) term premium estimates. Next, we construct recession forecasting models based on these components, following the approach of Estrella and Hardouvelis.

² The Wright (2006) model also signaled an imminent recession. According to Fernald and Trehan (2006), that model estimated a 47 percent chance of recession over the next four quarters based on data from November 8, 2006.

³ Recent papers document significant differences in the cyclical properties of the term spread's expectations component and its term premium component. Most of this work focuses on predicting real activity using GDP growth (such as Ang, Piazzesi, and Wei [2006]), but little consideration has been given to the effect of the term premium in forecasting recessions. One exception is Wright (2006), who includes the Cochrane and Piazzesi (2005) excess bond return factor with the term spread to forecast National Bureau of Economic Research (NBER) recessions. However, Wright's model does not explicitly decompose the term spread.

We find that the expectations component model is similar to the standard term spread model: Both models accurately predict all six recessions since 1961 when the signal threshold is set to a twelve-month recession probability of 25 percent. The term spread model passes this threshold again from August 2006 to May 2007, giving recession probabilities of up to 37 percent, while the expectations component model gives probabilities below 18 percent.

Our analysis provides some evidence that the expectations component model is the more accurate of the two. However, we do not have enough historical data to reach a definitive conclusion about which model is superior. Furthermore, measurements of the term premium are imprecise, a factor that adds uncertainty to forecast models that exclude this component from the term spread.

2. DECOMPOSING THE TERM SPREAD

The *term spread*—the observed difference between the yield on a long-term and a short-term bond—reflects a combination of underlying factors. Its largest component is investors' expectations about future short-term interest rates. We refer to the difference between average expected short-term rates over the lives of the two bonds as the *expectations component* of the term spread. The remaining difference in yield compensates investors for the risks associated with holding long-term rather than short-term investments. We call this the *term premium component*. Neither component is directly observable, so we measure term premia using a statistical model and attribute the balance of the term spread to the expectations component. The relationship between the term spread and its components is given in equation 1:

$$(1) \text{ term spread} = \text{expectations component} + \text{term premium component}.$$

In turn, each component includes both inflation-related and real factors:

$$(2) \text{ expectations component} = \text{inflation expectations} + \text{real rate expectations}$$

$$(3) \text{ term premium component} = \text{inflation risk premium} + \text{real rate risk premium}.$$
⁴

Thus, the expectations component of the term spread measures the difference in anticipated average inflation over

⁴ Durham (2006) decomposes nominal rates into the expected real rate, expected inflation, the real term premium, and the inflation risk premium. Longstaff and Schwartz (1992), Engle, Lilien, and Robins (1987), and Wachter (2006) develop models in which the term premium depends on interest rate risk and risk aversion.

long and short horizons, plus the difference in anticipated average real rates over long and short horizons. Changes in the expectations component are likely to be dominated by variation in short-term expectations. Changes in the term premium component, however, are expected to be driven primarily by the long-term risk outlook, since relatively little compensation is needed for short-term risk. We would thus expect the term premium component to decline as investor uncertainty about long-term productivity improves (indicating reduced real rate risk) and as inflation expectations become more stable.⁵

3. MEASURING TERM SPREAD COMPONENTS

A standard measure of the term spread is the difference between ten-year and three-month Treasury yields. We follow this convention in our empirical analysis. Our ten-year constant-maturity rate and three-month secondary-market rate are taken from the Federal Reserve's H.15 Statistical Release.⁶

While term premia cannot be observed, there are a variety of estimation approaches that incorporate both macroeconomic and financial market data. Although current models are far from perfect, Rudebusch, Sack, and Swanson (2007) find that different techniques generate remarkably similar results.⁷ The five models they compare produce ten-year term premium estimates that are highly correlated. They report that the Kim and Wright (2005) measure is the most representative,⁸ so we use estimates from this model in our analysis.

Kim and Wright isolate the term premium component from the expectations component using a term structure model that requires all bonds to be priced fairly (see, for example, Duffee [2002]). According to this approach, each bond's price is equal

to its expected future value minus a discount to compensate investors for that particular bond's risk. Additional restrictions on the behavior of bond values and risk premia over time allow these components to be estimated using historical interest rate data.

More specifically, in the Kim and Wright model, three unobserved factors drive interest rate changes. Tang and Xia (2007) show that these three factors are correlated with the current interest rate level, the slope of the yield curve, and the curvature of the yield curve.⁹ In turn, Dewachter and Lyrro (2006) show that the level factor can be interpreted as the long-run inflation expectations of investors. The slope and curvature factors capture the current economic outlook and the stance of monetary policy, respectively.

The Federal Reserve Board provides data from the Kim and Wright model at a daily frequency. We measure the term spread's term premium component by calculating the difference between the Kim and Wright ten-year par term premium and three-month instantaneous term premium estimates.

These data begin in 1980, but we would like to go back farther to include more recessions in our analysis. Cochrane and Piazzesi (2005) show that the term premium can be

While term premia cannot be observed, there are a variety of estimation approaches that incorporate both macroeconomic and financial market data.

estimated as a linear function of forward Treasury rates. We use a similar technique to identify the relationship between forward rates and the Kim and Wright term premium component. We assume that the post-1980 relationship holds before 1980 as well and estimate the term premium from forward rates over the entire period in which they are available.

Specifically, we regress the Kim and Wright term premium component on daily one- to seven-year instantaneous forward rates from January 1980 to July 2007, using data from the yield-curve model produced by Gurkaynak, Sack, and Wright (2006). Our model has an excellent fit, with an adjusted R^2 of 99.0 percent and a root mean squared error of less than 7 basis points.¹⁰ Forward rate data are available since July 1961, so we use fitted values from our model to represent the term

⁵ Vasicek (1977) shows that the term premium depends on interest rate volatility and the maturity of the bond. Several empirical papers confirm this relationship. Hamilton and Kim (2002) find that the term premium is closely linked to long-term interest rate volatility, while Orphanides and Kim (2007) identify a strong relationship between the term premium and the dispersion of inflation forecasts. Beechey (2007) shows that most of the response of ten-year forward rates to macroeconomic news comes from changes in the term premium rather than expected future short-term rates.

⁶ We are grateful to Arturo Estrella for providing the term spread data. Estrella converts the three-month rate from a discount rate to a bond-equivalent rate, as described in Estrella and Trubin (2006).

⁷ Rudebusch, Swanson, and Wu (2006) present evidence that a decline in the term premium (using estimates from macro-finance models) is unable to fully explain the behavior of yields during the 2004-05 period. See also Swanson (2007).

⁸ The Kim and Wright (2005) term premium estimate has a 99 percent correlation to the first principal component of the five measures that Rudebusch, Sack, and Swanson (2007) compare. The first principal component represents the most important common variation among models.

⁹ Litterman and Scheinkman (1991) identify these factors as the ones that effectively characterize the shape of the yield curve.

¹⁰ The equation for the fitted term premium component is $-0.85 - 0.78 f_1 + 4.32 f_2 - 15.62 f_3 + 33.71 f_4 - 41.01 f_5 + 26.68 f_6 - 7.06 f_7$, where f_t is an instantaneous forward rate at year t .

premium component from 1961 to 2007.¹¹ We subtract these values from the term spread to obtain the estimated expectations component. Finally, we take monthly averages of the term spread and its two components.

4. RELATING TERM SPREAD COMPONENTS TO RECESSIONS

Chart 1 shows monthly averages of the term spread, its expectations component, and its term premium component from 1961 to 2007. During this period, there were six recessions as defined by the NBER.

The term spread and the expectations component generally range from 0 percent to 3 percent during periods of economic expansion, but decline to especially low levels immediately before each recession. Preceding a recession, the term spread consistently falls below 0 percent and the expectations component falls below -1 percent. Furthermore, the two measures reach these low levels *only* in the months preceding recessions.¹² Low levels of the term spread or expectations component seem to provide reliable predictions of upcoming recessions.¹³

In contrast, the term premium component follows a longer trend. It usually ranges from 0 percent to 1.5 percent, rising above 2 percent in the 1980s and generally declining thereafter. There is no clear pattern linking its level to the business cycle.

To quantify the recession likelihood indicated by the term spread and its components, we estimate probit models following the approach of Estrella and Hardouvelis (1991).¹⁴ First, we represent the state of the economy as a variable equal to 0 during economic expansion and 1 during recession (which we define as the month following an NBER business-cycle peak through the month of the trough). Then, we map the level of the term spread at time t to the state of the economy twelve months later by calibrating the equation

$$(4) \quad (\text{recession indicator})_{t+12} = \Phi(\alpha + \beta * \text{spread}_t),$$

¹¹ This procedure treats the forward rates as instrumental variables, correcting for bias due to estimation error in the Kim and Wright term premium data from which our independent variables are derived.

¹² There are two possible exceptions to this rule: the term spread declines below 0 percent in 1966 and in 2006-07, as we discuss in the next section.

¹³ We use this observation to motivate our statistical models, but we do not focus on the threshold at which the expectations component would signal a recession. The expectations component is always less than the term spread because the term premium is positive, so this threshold is likely to be lower than zero. In other words, a negative level of the expectations component is not expected to be sufficient to generate a recession signal.

¹⁴ In a probit model, the variable to be explained is equal to either 0 or 1. The probability of state 1 occurring is given by a linear combination of explanatory variables inserted into a cumulative normal distribution function.

where spread_t is the term spread at time t , (*recession indicator*) _{$t+12$} is the state of the economy twelve months after t , and α and β are estimated coefficients. Φ is the cumulative normal distribution function, which maps its contents to a value between 0 and 1.

After estimating the model's coefficients, we can use equation 4 to calculate from the level of the term spread the probability of economic recession in twelve months. We also produce similar models using the expectations component, the term premium component, or a combination of the two in place of the term spread.

In their empirical analysis using data from 1955 to 1988, Estrella and Hardouvelis report that the coefficient on the term spread (β) is negative. So, as the long-term rate falls relative to the short-term rate, the predicted recession probability rises. They find that the model fits recessions well, with a pseudo- R^2 of 30 percent.

Table 1 presents estimation results for the equation 4 specification using the term spread alone (column 1), each term spread component separately (columns 2 and 3), and the two components together (column 4). The sample period is July 1961 to July 2006.¹⁵ Our estimated term spread model is quite similar to that of Estrella and Hardouvelis. We obtain a negative and highly significant term spread coefficient, and the model fit is good, with a pseudo- R^2 of 25.5 percent.

The expectations component results are very close to those of the term spread. The estimated expectations component coefficient is negative and highly significant, and the model's pseudo- R^2 (27.4 percent) is higher than that of the term spread model. However, the term premium component model performs poorly: The coefficient on the term premium component is not statistically significant, and the model has no explanatory power. When we use both term spread components together, the expectations component remains significant, the term premium component remains insignificant, and the model fit shows a slight improvement.

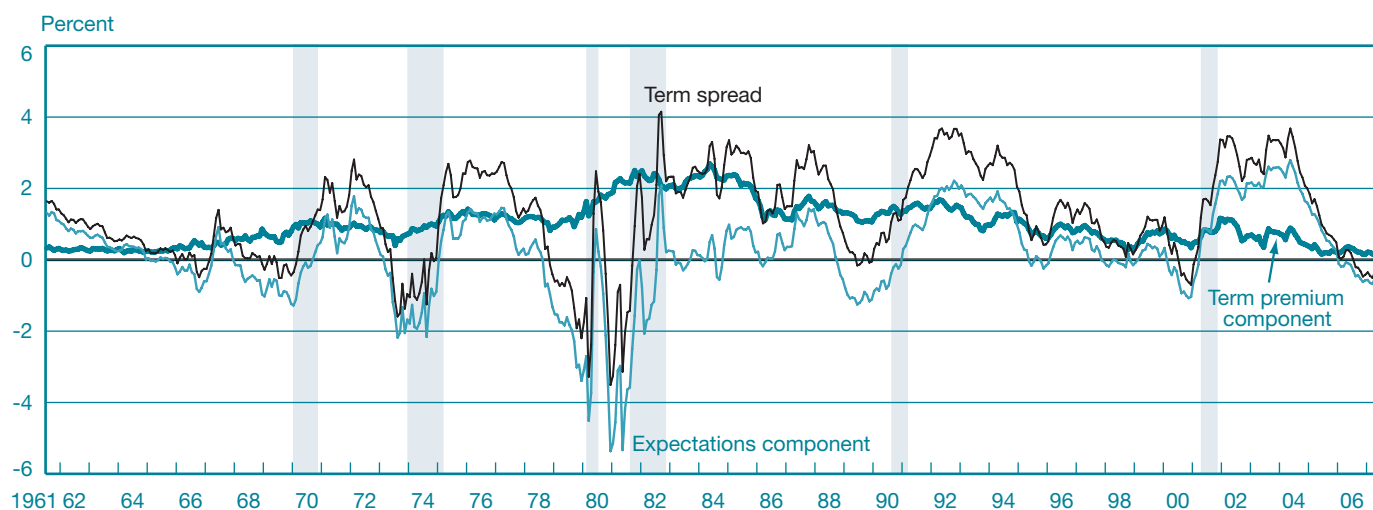
5. PREDICTING RECESSIONS

Chart 2 gives the probability forecasts produced by the term spread and expectations component probit models. As expected, they reach their highest values in the year-and-a-half before a recession. The two forecasts generally track each other closely. However, the expectations component model produces higher recession probabilities than the term spread model does in the mid-1980s and lower probabilities during the 1960s, the late 1990s, and the current cycle.

¹⁵ When we extend the sample period through November 2006, the estimation results are essentially the same, but the model fit is slightly weaker.

CHART 1

Term Spread and Components



Sources: Board of Governors of the Federal Reserve System; authors' calculations.

Note: The shaded areas indicate periods designated national recessions by the National Bureau of Economic Research.

TABLE 1

Recession Forecasting Model Estimation Results

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.73***	-1.44***	-1.31***	-1.21***	-1.62***	-1.19***
Term spread	-0.78***				-0.57***	
Expectations component		-0.77***		-0.81***		-0.87***
Term premium component			-0.13	-0.26		
Fed funds effective rate					0.11***	-0.04
Number of observations	541	541	541	541	541	541
Estrella pseudo-R ² (percent)	25.5	27.4	0.2	27.9	28.3	27.5
Log likelihood	-133	-128	-198	-127	-126	-128

Source: Authors' calculations.

Note: The dependent variable is the National Bureau of Economic Research recession indicator twelve months ahead, from July 1961 to July 2006.

***Statistically significant at the 1 percent level.

**Statistically significant at the 5 percent level.

*Statistically significant at the 10 percent level.

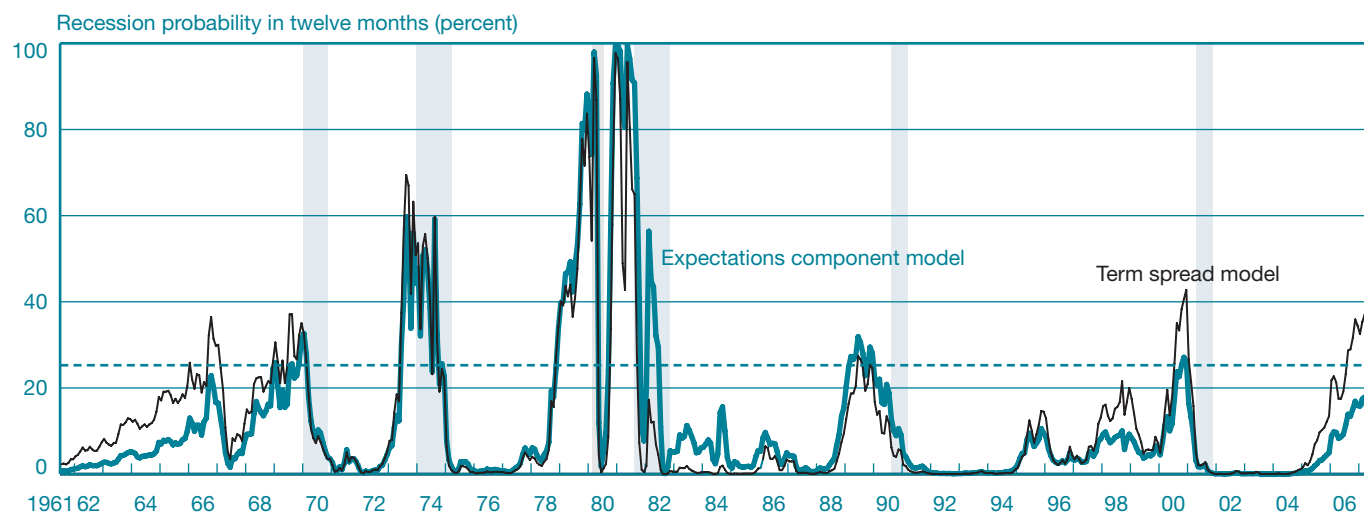
A look at the forecasts that precede the six recessions in our sample helps to interpret these model-based probabilities. We first find the minimum probability level indicated by both models before all recessions. This threshold, 25 percent, can be interpreted as the most conservative recession indicator that would not have missed any recessions in the past.¹⁶

Both models tend to breach the 25 percent threshold (the dashed line in Chart 2) at the same time. One exception is that

¹⁶ The term spread model's forecast rises above 25 percent for three months prior to the 1990-91 recession, peaking at 27 percent. The expectations component forecast rises above 25 percent for three months prior to the 2001 recession, also peaking at 27 percent. All other recessions are preceded by higher and longer forecasts from both models. A 25 percent forecast occurs when the term spread declines just past 0 percent or when the expectations component declines to about -1.0 percent. Similarly, Estrella (2005b) finds that a reliable recession signal is generated when the term spread falls below about 0 percent, which is equivalent to a 30 percent recession probability from his probit model.

CHART 2

Recession Probability Forecasts



Source: Authors' calculations.

Notes: The shaded areas indicate periods designated national recessions by the National Bureau of Economic Research. The dashed line denotes the historical recession prediction threshold. Model estimates are reported in Table 1, columns 1 and 2.

TABLE 2

Recession Forecasting Signals

NBER Recessions		Term Spread Signals			Expectations Component Signals		
Beginning	Length	Beginning	Lead	Length	Beginning	Lead	Length
Jan. 1970	11	Dec. 1968	13	15 ^a	Jan. 1969	12	14 ^a
Dec. 1973	16	June 1973	6	16 ^a	June 1973	6	18 ^a
Feb. 1980	6	Nov. 1978	15	18	Dec. 1978	14	17
Aug. 1981	16	Oct. 1980	10	12	Oct. 1980	10	21 ^a
Aug. 1990	8	June 1989	14	6 ^a	Mar. 1989	17	10 ^a
Apr. 2001	8	July 2000	9	7	Oct. 2000	6	3
Average	10.8		11.2	12.3		10.8	13.8

Sources: National Bureau of Economic Research; authors' calculations.

Notes: A recession signal is a forecast probability greater than 25 percent. Lead times and lengths are in months.

^aDenotes a noncontinuous signal.

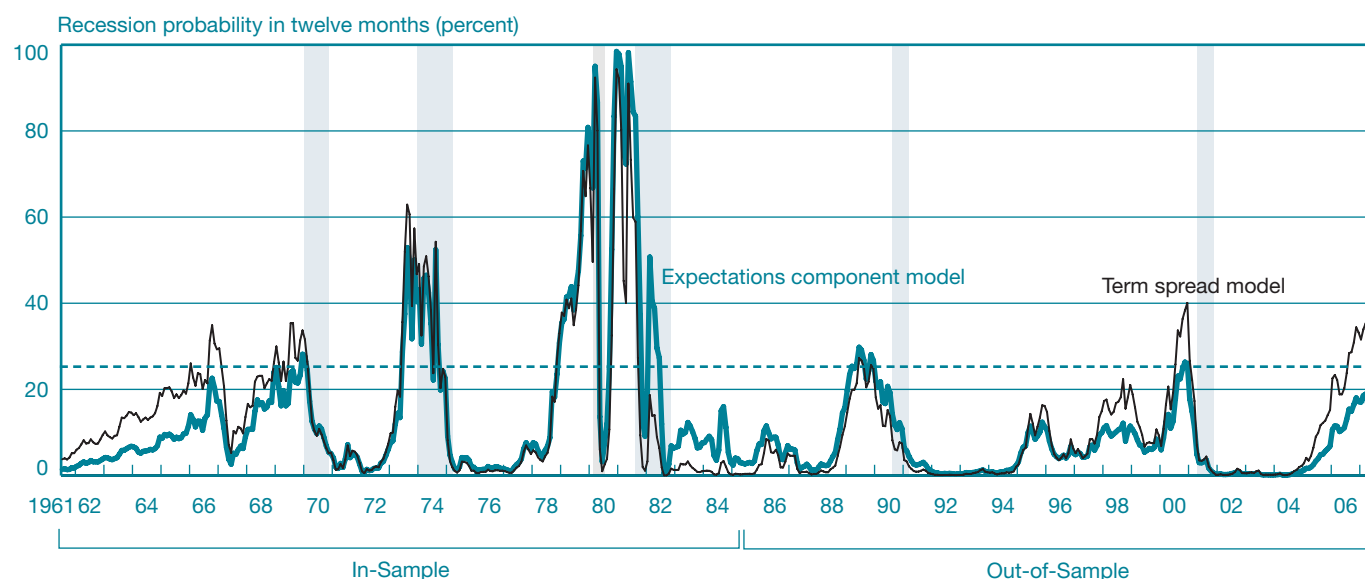
the term spread model produces a recession forecast of 37 percent in 1966, while the expectations component model reaches only 23 percent. This result precedes a brief economic downturn that is commonly identified as a “credit crunch” episode (see Burger [1969]) but is not classified as a recession by the NBER. The only other exception occurs in the last two years. From August 2006 to May 2007, the term spread model predicts a recession probability of between 26 percent and 37 percent, while the expectations component model never rises above

18 percent. As of December 2007, the subsequent period has not been classified as a recession by the NBER.

Table 2 compares the warning signals given before each recession as the two model forecasts rise above 25 percent. Signals begin six to seventeen months before a recession, with an average lead time of eleven months. Signals last from three to eighteen months, with an average duration of thirteen months. The overall timing and duration of signals from the two models are similar.

CHART 3

Out-of-Sample Recession Probability Forecasts



Source: Authors' calculations.

Notes: The shaded areas indicate periods designated national recessions by the National Bureau of Economic Research. The dashed line denotes the historical recession prediction threshold. Model estimates are reported in Table 1, columns 1 and 2.

Estrella and Mishkin (1998) show that this type of model may forecast recessions that occur within the regression sample period (in-sample) without being able to forecast recessions that occur after the model estimation period (out-of-sample). We conduct a split-sample test to determine whether this affects our models, estimating each one over the 1961-84 period and then measuring its forecast accuracy from 1985 to 2007.¹⁷ Because the out-of-sample period contains only two recessions, small-sample bias may affect our results (Gart and Zweifel 1967).

Estimation results based on the 1961-84 sample (Table 3, columns 1 and 2) are very similar to those based on the full 1961-2006 sample (Table 1, columns 1 and 2). The term spread and expectations component coefficients are somewhat smaller, but remain negative and highly significant. The short-sample models have in-sample fits that are similar to their full-sample fits. Their out-of-sample fits are only a few percentage points lower (22.3 percent for the expectations component model and 22.4 percent for the term spread model), indicating that these models' forecasting ability

remains strong after the sample period ends. Chart 3 shows that the out-of-sample recession probability forecasts of the short-sample models are close to the full-sample forecasts.

TABLE 3

In-Sample and Out-of-Sample Estimation Results

	(1)	(2)	(3)	(4)
Constant	-0.71***	-1.33***	-1.67***	-1.38***
Term spread	-0.65***		-0.45***	
Expectations component		-0.65***		-0.63***
Fed funds effective rate			0.11***	0.01
Number of observations	282	282	282	282
In-sample Estrella				
pseudo-R ² (percent)	25.2	28.1	29.7	28.1
Out-of-sample Estrella				
pseudo-R ² (percent)	22.4	22.3	23.0	22.1
In-sample log likelihood	-95.1	-91.1	-88.9	-91.0

Source: Authors' calculations.

Note: The dependent variable is the National Bureau of Economic Research recession indicator twelve months ahead, from July 1961 to December 1984. The in-sample estimation period is July 1961 to December 1984. The out-of-sample forecast period is January 1985 to July 2006; we use a full-sample July 1961 to July 2006 fitted constant model as a performance baseline. The sample period for estimating the term premium component from forward rates is January 1981 to December 1984.

¹⁷ We extrapolate the term premium component using parameters from a regression of the Kim-Wright measure on forward rates from 1981 to 1984. This model's adjusted R² is 87 percent and its root mean squared error is 12 basis points. Thus, the expectations component data used in our split-sample model may be less accurate than those used in our full-sample model.

6. ALTERNATIVE RECESSION FORECASTING MODELS

We next consider two modifications to our model specifications. Wright (2006) uses the federal funds rate in addition to the term spread (and several other variables) to predict NBER recessions.¹⁸ In Table 1, columns 5 and 6, we augment the models in columns 1 and 2 by adding the federal funds rate.¹⁹ This new term is significant along with the term spread, but not along with the expectations component. Table 3 shows similar results for the short-sample estimations (columns 3 and 4). The addition of the federal funds rate

[Our] results suggest that the federal funds rate and the expectations component of the term spread contain similar information, which is consistent with the link between the monetary policy cycle and expectations of short-term interest rates.

improves the fit of the term spread model, raising its pseudo- R^2 from 25.5 percent to 28.3 percent in the full sample and from 25.2 percent to 29.7 percent in the short sample. However, it improves the term spread model's out-of-sample performance only marginally. These results suggest that the federal funds rate and the expectations component of the term spread contain similar information, which is consistent with the link between the monetary policy cycle and expectations of short-term interest rates.

Rudebusch, Sack, and Swanson (2007) use spread changes rather than spread levels to predict GDP growth. We adapt their approach to investigate the explanatory power of spread changes for NBER recessions (see also Estrella and Trubin [2006]). We find that both the term spread change and the expectations component change are statistically significant recession predictors (Table 4). However, the levels models have substantially better in-sample fit and out-of-sample forecasting

¹⁸ Wright (2006) finds that the federal funds rate coefficient is positive and highly significant in his recession forecasting model. He uses a somewhat different recession measure than we do, forecasting the likelihood that there will be a recession at any point in the upcoming six quarters rather than a recession in exactly twelve months.

¹⁹ We use the average effective federal funds rate reported in the Federal Reserve's H.15 Statistical Release.

TABLE 4
Estimation Results Using Changes

	(1)	(2)	(3)
Constant	-1.31***	-1.37***	-1.17***
Twelve-month change in term spread	-0.36***		
Twelve-month change in expectations component		-0.50***	
Twelve-month change in term premium component			0.34
Number of observations	529	529	529
Estrella pseudo- R^2 (percent)	8.7	12.3	0.5
Log likelihood	-174	-165	-196

Source: Authors' calculations.

Note: The dependent variable is the National Bureau of Economic Research recession indicator twelve months ahead, from July 1962 to July 2006.

TABLE 5
In-Sample and Out-of-Sample Estimation Results Using Changes

	(1)	(2)
Constant	-1.03***	-1.11***
Twelve-month change in term spread	-0.41***	
Twelve-month change in expectations component		-0.51***
Number of observations	270	270
In-sample Estrella pseudo- R^2 (percent)	14.6	17.8
Out-of-sample Estrella pseudo- R^2 (percent)	-7.6	-1.9
In-sample log likelihood	-108	-104

Source: Authors' calculations.

Note: The dependent variable is the National Bureau of Economic Research recession indicator twelve months ahead. The in-sample estimation period is July 1962 to December 1984. The out-of-sample forecast period is January 1985 to July 2006; we use a full-sample sample July 1962 to July 2006 fitted constant model as a performance baseline. The sample period for estimating the term premium component from forward rates is January 1981 to December 1984.

performance than do the changes models. For example, the full-sample pseudo- R^2 for the term spread levels model is 25.5 percent compared with only 8.7 percent for the changes model. The out-of-sample pseudo- R^2 for both changes models is negative (Table 5), indicating that their performance is worse than the performance of a model with only a constant term.

7. CONCLUSION

Since the 1970s, an inverted yield curve has been a reliable signal of an imminent recession. One interpretation of this signal is that it reflects market expectations that current monetary policy is tighter than it will be in the future, owing to an upcoming deterioration in the economic outlook. If the yield-curve signal comes from interest rate expectations, then a model using only the expectations component of the term spread (removing the term premium component) should produce more accurate forecasts.

Our empirical analysis finds that the expectations component is indeed a leading indicator of recession,

while the term premium component is not. When we compare the historical recession forecasting performance of the term spread and its expectations component, we find some evidence that a model based on the expectations component is more accurate. Our results should be interpreted with caution, however, because they rely on imprecise estimates of the term premium and on a sample period that includes only six recessions.

More recently, from August 2006 to May 2007, the term spread model signaled an imminent recession, but the expectations component model did not. The near future will likely shed light on the relative accuracy of these models.

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POVERTY IN NEW YORK CITY, 1969-99: THE INFLUENCE OF DEMOGRAPHIC CHANGE, INCOME GROWTH, AND INCOME INEQUALITY

- Despite gains in employment, income, and educational attainment, New York City experienced a rise in poverty from 1969 to 1979 and a continued high rate from 1979 to 1999.
- A study of the impact of several purported causes of poverty in the city finds that certain key demographic changes are associated with the rise in poverty and its persistence.
- Dwarfing the impact of the demographic changes, however, was a dramatic increase in income inequality from 1979 to 1999 driven by a widening disparity in wage rates.

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1. INTRODUCTION

The four-year rise in the U.S. poverty rate that began with the recession of 2001 and the images of devastation from New Orleans after Hurricane Katrina has led to a renewed interest in poverty among researchers and policymakers. Mayors of large cities have been prominent in the renewed discussion. In 2006, New York City Mayor Michael Bloomberg convened the Commission on Economic Opportunity, which offered recommendations for reducing poverty in the city and led to the formation of the City of New York's Center for Economic Opportunity.¹ In early 2007, the U.S. Conference of Mayors' Task Force on Poverty, Work, and Opportunity issued a report detailing an agenda for poverty reduction in America.²

Policies for addressing poverty are influenced by its perceived causes. For example, single parenthood is commonly thought to be a root cause of poverty. This perception suggests policies that promote marriage. Among those who see poverty

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as the result of low wages, policies such as increasing the minimum wage or the earned income tax credit are often favored. In this article, we evaluate the impact of these and other purported causes of poverty in New York City from 1969 to 1999 and their policy consequences.

Factors influencing change in the poverty rate can be grouped into two categories: demographic and economic. This study examines the effect of the demographic factors of race, nativity, family structure, and educational attainment as well as the economic factors of income growth, income inequality, and earnings inequality on changes in the city's poverty rate. (See Box 1 for a discussion of this measure.) We find that demographic factors, coupled with a sharp drop in mean family income, played a leading role in the dramatic rise in the New York City poverty rate from 1969 to 1979. However, from 1979 to 1999—a period marked by a stable but stubbornly high poverty rate—growing income inequality largely explains why an impressive rebound in mean family income did not lead to

We evaluate the impact of . . . purported causes of poverty in New York City from 1969 to 1999 and their policy consequences.

a decline in the share of city residents living below the poverty line. This increase in inequality, in turn, can be traced to the stagnation of wages at the low end of the earnings distribution. Despite substantial demographic and economic differences between New York City and the United States, our results echo findings in research for the nation at large.

The outline of our study is as follows: In Section 2, we show how two demographic shifts—growth in the share of the city's black and Hispanic populations and an increase in the share of those living in female-headed families—are clearly associated with the rise in poverty from 1969 to 1979 and the failure of the poverty rate to fall from 1979 to 1999. However, in the subsequent section, placing these factors in the context of New York City's income growth and expanding income inequality reveals that the rise in inequality (net of the influence of demographic change) plays a more influential role in the 1979-99 stability of the poverty rate than do the aforementioned

¹ New York City Commission for Economic Opportunity, "Report to Mayor Michael R. Bloomberg: Increasing Opportunity and Reducing Poverty in New York City," September 2006.

² U.S. Conference of Mayors, "Repairing the Economic Ladder: A Transformative Investment Strategy to Reduce Poverty and Expand America's Middle Class," January 2007.

Box 1

Measuring Poverty

The United States has an "official" poverty measure that federal statistical agencies such as the Census Bureau use in their reports. This study uses this official measure, which compares a family's pre-tax cash income to a set of thresholds that vary by family size and composition. Members of a family are considered to be in poverty if the family's total income is less than the appropriate threshold. For 1999, the last year of our analysis, the poverty threshold (in 1999 dollars) for a single parent with two children was \$13,423; the threshold for a two-parent family of four was \$16,895.^a

While the federal poverty measure has its shortcomings, it remains a commonly used measure among researchers.^b Given the limitations of the income data available in the decennial census, we did not attempt to use an alternative methodology.

^aFor information on how the poverty thresholds were first developed and have changed over time, see Gordon M. Fischer, "The Development and History of Poverty Thresholds," *Social Security Bulletin* 55, no. 4 (winter 1992): 3-14.

^bFor a critique and suggested alternative, see Committee on National Statistics, Commission on Behavioral and Social Sciences and Education, *Measuring Poverty: A New Approach. Report of the Panel on Poverty and Family Assistance: Concepts, Information Needs, and Measurement Methods*. Washington, D.C.: National Academy Press, 1995.

demographic changes.³ Section 4 explores the sources of this growing inequality and finds that the increasing inequality of earnings among persons living in full-year working families is a pervasive force underlying the overall rise in inequality. Section 5 briefly discusses policy responses.

2. POVERTY IN NEW YORK CITY, 1969-99

New York City's poverty rate rose dramatically during the 1970s (Table 1). In 1969, 14.5 percent of residents lived below the poverty line, a rate comparable to the nation's 13.7 percent. By 1979, one in five city residents, or 20.2 percent, lived in poverty. In 1999, the poverty rate stood at 21.9 percent, more than 7 percentage points above the 1969 level and nearly

³ While there were striking events in the 1990s that might be expected to affect the official poverty rate—welfare reform, wage increases during the economic boom in the second half of the 1990s, the slowing of the increase in female-headed households—our analysis of the impact of demographic changes on the poverty rate did not reveal sharp differences between the 1980s and 1990s. Thus, we combine these periods to simplify the presentation.

TABLE 1

Poverty Rates for New York City and the United States

Year	New York City	United States
1969	14.5	13.7
1979	20.2	12.4
1989	18.8	13.1
1999	21.9	12.4

Source: Authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census (1970-2000), Census Historical Poverty Tables (<<http://www.census.gov/hhes/www/poverty/census/cph162.html>>), and Census 2000 Summary Tape File 3.

10 points above the U.S. rate of 12.4 percent. (While the poverty rate tends to rise and fall with the business cycle—see Chart 1—the years 1969, 1979, 1989, and 1999 correspond closely to business cycle peaks and thus enable us to investigate the secular trend.)

The large increase in the poverty rate in the 1970s, a decade when the city struggled with the effects of a deep national recession and its own fiscal crisis, is not surprising. From 1969 to 1979, the city's population declined from 7.9 million to 7.1 million, payroll employment fell from 3.8 million to 3.3 million jobs, and median family income plunged from \$36,543 to \$29,878. Chart 2 illustrates that the post-1969 rise in poverty was not unique to New York.

In the 1980s and 1990s, the city enjoyed an impressive recovery. Payroll employment rose and fell with the business cycle, reaching 3.7 million jobs by 2000, only slightly below the city's 1969 all-time high. Population also recovered, reaching 8 million in 2000, and median family income rebounded to \$35,000 by 1999. Despite these gains, however, the poverty rate did not decline. New York's poverty rate in 1999 was 21.9 percent, nearly 2 percentage points *above* the 1979 rate of 20.2 percent.^{4,5}

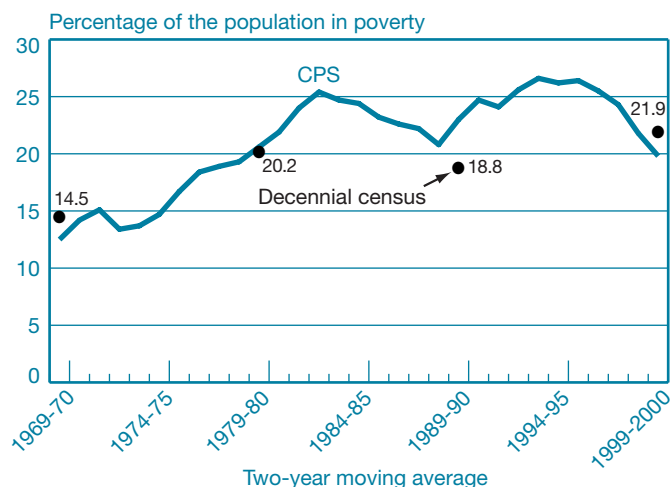
Several recent studies (Freeman 2001; Danziger and Gottschalk 2003; Iceland 2003; Hoynes, Page, and Stevens 2006) have investigated an analogous question concerning the

⁴ Income figures are based on the authors' calculations using the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census for 1970, 1980, 1990, and 2000. Income is expressed in 1999 dollars and is adjusted for inflation using the CPI-U. Population figures are from the Regional Economic Information System of the U.S. Department of Commerce's Bureau of Economic Analysis. Payroll employment figures are from the Current Employment Statistics Survey of the U.S. Department of Labor's Bureau of Labor Statistics.

⁵ The restriction of family resources to pre-tax cash income means that tax credits and in-kind benefits are not accounted for in the official measure. Thus, the rise in the poverty rate from 1979 to 1999 may overstate the deterioration of conditions in the city. We do not believe that this possible effect undermines our analysis of the 1979-99 stability of the city poverty rate.

CHART 1

The Cyclical Behavior of New York City's Poverty Rate



Source: Authors' calculations, based on the Current Population Survey (CPS) of the U.S. Bureau of Labor Statistics/U.S. Census Bureau and the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau.

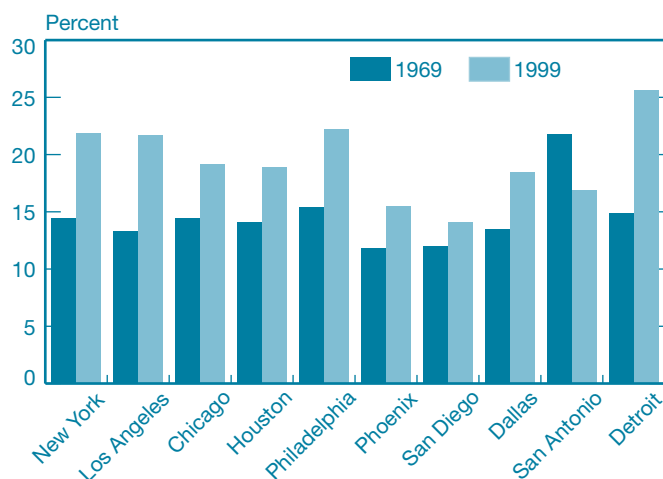
Notes: The chart places the poverty rates estimated from the decennial census in the context of the cyclical pattern of change, measured by a two-year moving average for the poverty rate estimated from the CPS. Given the extended economic difficulties the city faced during the 1970s, the poverty rate rose steadily. Its continued climb into the early 1980s reflects the post-1979 recession. From 1982 to 1983, the poverty rate declined as the city economy rebounded, reaching a cyclical low of 20.8 percent (estimated from the CPS) in 1988-89. The corresponding poverty rate for 1989, derived from the decennial census, was 18.8 percent. The recession of the early 1990s brought another period of increased poverty to the city, peaking at 26.6 percent in 1993-94. The strong local economy of the second half of the 1990s pushed the poverty rate down to 19.8 percent in 1999-2000. The corresponding estimate from the decennial census was 21.9 percent.

national poverty rate: Why, despite continued growth in median and per capita incomes, has there been so little change in the U.S. poverty rate since the early 1970s? These studies find that the increase in female-headed families is the chief demographic factor impeding the translation of economy-wide income gains into poverty rate declines. But they also highlight the importance of the rise in income inequality—partially attributable to stagnant or declining wages at the low end of the earnings distribution—in the poverty rate's inability to fall. The studies uniformly conclude that rising earnings inequality had a greater influence on the nation's poverty rate than did demographic change.⁶

In the context of this literature, New York City is an interesting test case. Over the past three decades, the city has undergone dramatic demographic changes that have increased

CHART 2

Poverty Rates in the Ten Largest U.S. Cities, 1969 and 1999



Sources: U.S. Census Bureau, 1970 and 2000 Decennial Census Summary Tape File 3; authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau (for New York City).

Notes: The chart places the New York City poverty rate in the context of rates for the ten largest cities in the nation. It shows that the post-1969 rise in poverty was common across large cities. It also suggests that the 1999 New York City poverty rate was not as high as the rate for other urban areas such as Detroit. However, New York City's rate was considerably higher than rates for the Sun Belt cities of San Antonio, Phoenix, and San Diego.

its share of poverty-prone groups such as immigrants, racial and ethnic minorities, and persons living in female-headed families. For example, in 1970 nearly half (47.6 percent) of New York's population was composed of non-Hispanic whites living in husband-wife families. By 2000, the proportion in this category had fallen to one in five (20.5 percent).⁷ The city is also notable for its high and growing levels of income inequality. The ratio of family income at the 90th and 10th deciles of the income distribution rose from 11.5 in 1979 to 18.4 in 1999.⁸ Among U.S. cities, New York had the eleventh highest level of income inequality in 1979; by 1999, it ranked fourth.⁹

⁶ These studies represent only one line of inquiry in the recent literature. Another response to the question of why the U.S. poverty rate has failed to fall as incomes have risen is that the standard method by which poverty is measured is flawed and does not detect the considerable improvement in material well-being within the low-income population. For an example of this view of poverty, see Eberstadt (2006).

⁷ Authors' calculations using the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census.

⁸ Authors' calculations using the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census.

⁹ Analysis by Andrew Beveridge, reported in "In Manhattan, Poor Make 2 Cents for Each Dollar to the Rich," *New York Times*, September 4, 2005.

These trends suggest that there are really two separate questions to be asked about changes in the New York City poverty rate from 1969 to 1999:¹⁰ Why did the rate increase from 1969 to 1979? And why has it persisted in the low 20 percent range in the 1979-99 period? Our analysis in this and subsequent sections therefore treats these two time spans separately and focuses particularly on the 1979-99 period, in which the persistently high rate of poverty in the city stands in stark contrast to a coincident rise in both payroll employment and family income.

In this section, we quantify the effect of changes in the demographic composition of the city on New York's poverty rate relative to changes in within-demographic group poverty rates over time. We consider four demographic dimensions: nativity, educational attainment, family status, and race/ethnicity.¹¹ A simple decomposition framework provides two rather surprising results. First, the increasing share of the city population that is foreign-born had no *direct* effect on the

There are really two separate questions to be asked about changes in the New York City poverty rate from 1969 to 1999: Why did the rate increase from 1969 to 1979? And why has it persisted in the low 20 percent range in the 1979-99 period?

poverty rate. Second, widespread gains in educational attainment—that, all else constant, should have reduced the city's poverty rate—were offset by increasing poverty rates *within* all the educational attainment groups. Two demographic factors—family status and race/ethnicity—have the expected effect: each had a notable upward influence on the city poverty rate.

¹⁰ We use decennial census data rather than Current Population Survey (CPS) data because the latter include nativity data only as of 1994. While the CPS would allow for a time series analysis of intercensal fluctuations not possible with the decennial data, the large influx of immigrants to New York City during the 1969-99 period makes the ability to assess the effects of immigration on poverty critical to our analysis. Another drawback of the CPS is its limited sample of New York City residents, which complicates meaningful estimates of poverty rates for subgroups of the population. Note that because neither census nor CPS data allow for the tracking of individuals over time, the mobility of individuals in and out of poverty is not addressed.

¹¹ Two other potential factors are the age distribution of the population and family size. However, our analysis of the Census Bureau's 5-Percent Public Use Microdata Sample data indicates that New York City's population shifted away from the age group with the highest poverty rate, children under eighteen, and that mean family size decreased between 1970 and 2000. Children represented 28.9 percent of the city's population in 1970 and 24.0 percent in 2000. Mean family size declined from 3.6 to 3.3 persons per family from 1970 to 2000.

Box 2

Calculating the Demographic Share and Within-Group Effects

We estimate the demographic share and within-group effects of each of four demographic factors on the New York City poverty rate using a standard “shift share” analysis. For example, in the case of nativity (Table 2), we estimate that the shift toward foreign-born residents had little direct effect on the poverty rate between 1969 and 1979. The demographic share effect is -0.1, implying that the 5.7 percentage point increase in poverty during this period is the result of increases in the poverty rates for both native- and foreign-born New Yorkers (the “within-group rate effect”), rather than a shift toward the group with the higher rate in the initial period (the “demographic share effect”).

The demographic share effect is estimated using equation 3. The first term in the equation is a hypothetical poverty rate that simulates what the poverty rate would have been if the city had undergone its actual demographic change but poverty rates for each nativity group had remained at their 1969 levels. The term is calculated as the sum of the products of the poverty rates for each nativity group in 1969 and their share of the population in 1980 ($14.7(.764) + 13.5(.236)$) and it equals 14.4 percent. The difference between this hypothetical poverty rate and the actual poverty rate in 1969 (14.5 percent) is -0.1 percentage point. The within-group rate effect (estimated using equation 5) is calculated in an analogous way, by the difference between a hypothetical poverty rate constructed from the sum of the products of the poverty rates for each nativity group in 1979 and their respective shares of the population in 1970 ($21.2(.822) + 16.7(.178)$) and equals 20.4 percent. The difference between this hypothetical poverty rate and the actual poverty rate in 1969, labeled the “within-group rate effect” in Table 2, is 5.9 percentage points.

A residual term (labeled “interactive effect”) captures the change in the poverty rate attributable to the joint impact of the demographic share and within-group rate effect. In this case, it equals (after rounding) -0.2 percentage point. We repeat this analysis for educational attainment (Table 4), family status (Table 5), and race/ethnicity (Table 6).

2.1 Methodology

To illustrate the effect of population shifts on New York City’s poverty rate, we present the results of a series of simulations that measure the effect of these shifts relative to the influence of changes in the within-group poverty rates. For example, we measure the effect of the shift toward groups with higher levels of educational attainment (fewer high-school dropouts, more college graduates) relative to the effect of changes in the

poverty rate over time within these educational attainment groupings.

We use a standard “shift share analysis,” which takes advantage of the fact that the citywide poverty rate can be expressed as an average of the poverty rates for groups within the population weighted by each group’s population share (see Box 2). The difference between the poverty rates in any two years can therefore be written as:

$$(1) \quad \text{Poverty rate year two} - \text{poverty rate year one} \\ = \sum_{i=1}^N R_{i2} * S_{i2} - \sum_{i=1}^N R_{i1} * S_{i1},$$

where R is the group i poverty rate, S is the group i share of the population, and Σ is an operator denoting the sum of the products.

This suggests a way to construct a hypothetical poverty rate for year two that would simulate the poverty rate for that year if group shares of the population had changed but each group’s poverty rate was held constant:

$$(2) \quad \sum_{i=1}^N R_{i1} * S_{i2}.$$

The difference between this hypothetical and the actual poverty rate in year one is the change in poverty that is associated with the direct effect of the change in size of each group’s share of the population.

$$(3) \quad \text{Demographic share effect} = \sum_{i=1}^N R_{i1} * S_{i2} - \sum_{i=1}^N R_{i1} * S_{i1} \\ = \sum_{i=1}^N R_{i1} (S_{i2} - S_{i1}).$$

Another hypothetical poverty rate can be constructed by simulating the poverty rate in year two if group shares were unchanged but each group’s poverty rate had undergone its actual change:

$$(4) \quad \sum_{i=1}^N R_{i2} * S_{i1}.$$

The difference between this hypothetical and the actual poverty rate in year one is the change in the poverty rate that is associated with the direct effects of changes that occurred in the within-group poverty rates.

$$(5) \quad \text{Within-group rate effect} = \sum_{i=1}^N R_{i2} * S_{i1} - \sum_{i=1}^N R_{i1} * S_{i1} \\ = \sum_{i=1}^N S_{i1} (R_{i2} - R_{i1}).$$

A third term identified in the tables we present is labeled “interactive effect.” It represents the (typically small) joint

TABLE 2

Decomposition of Change in Poverty Rate by Nativity

	1969 Poverty Rate	1970 Population Share (Percent)	1979 Poverty Rate	1980 Population Share (Percent)	1999 Poverty Rate	2000 Population Share (Percent)
Citizen by birth	14.7	82.2	21.2	76.4	22.1	63.5
Foreign-born	13.5	17.8	16.7	23.6	21.7	36.5
Total	14.5	100.0	20.2	100.0	21.9	100.0
Memo:						
1969-79						
Demographic share effect		-0.1				
Within-group rate effect		5.9				
Interactive effect		-0.2				
Actual change		5.7				
1979-99						
Demographic share effect		-0.6				
Within-group rate effect		1.8				
Interactive effect		0.5				
Actual change		1.8				

Source: Authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census, 1970-2000.

effects of changes in the group rates and group shares. By construction, the sum of these three effects equals the actual change in the poverty rate.¹²

2.2 Effects of Demographic Shifts on the City's Poverty Rate

Nativity

The share of city residents born outside the United States doubled over the 1970-2000 period, increasing from 17.8 to 36.5 percent (Table 2). Since many immigrants arrive in the

¹² Following Danziger and Gottschalk (1993) and Iceland (2003), we use simulations and decomposition methods to calculate hypothetical poverty rates under different counterfactual assumptions. This methodology allows us to estimate the relative size of the effects of various phenomena associated with changes in the poverty rate: nativity, race/ethnicity, family status, educational attainment, economic growth, and income inequality. While this methodology has intuitive appeal and allows us to quantify the relative strength of the associations between poverty and broad economic and demographic trends, it has several limitations. As is the case with multiple-regression and other social science statistical models, simulations only suggest how strongly phenomena are related; they cannot identify causal relationships. Another limitation is that the method abstracts from interactions among the variables. For instance, it assumes that an increase in the foreign-born population will not affect the poverty rate of the native-born.

country with few years of formal schooling and minimal English skills, it is often assumed that the growing share of the population that is foreign-born is exerting upward pressure on the city's poverty rate. But in each of the two periods studied, the demographic share effect for nativity is negative (-0.1 and -0.6, respectively) and negligible relative to the actual change in the poverty rate (5.7 percentage points from 1969 to 1979 and 1.8 percentage points from 1979 to 1999).¹³

The reason for this perhaps surprising result is apparent from the table. In each census year, the poverty rate for foreign-born New Yorkers is lower than it is for the native-born.¹⁴ The negative sign in the decompositions is simply the result of the shift in the population toward the group with the lower poverty rate.

In Table 3, we investigate demographic changes within the two nativity groups that help to explain this seemingly counterintuitive result. The small size of the share effect indicates that changes in the citywide poverty rate were being

¹³ A peculiarity of decennial census data is that the data report demographic characteristics at the time of the survey but measure poverty for the prior calendar year. Thus, in Table 2 and other tables, the poverty rates are for 1969, 1979, and 1999, while the population shares are for 1970, 1980, and 2000.

¹⁴ The group we refer to as "native-born" is more precisely categorized as "citizens by birth" because it includes persons born in U.S. outlying areas such as Puerto Rico as well as children born abroad of U.S. parents. For ease of exposition, we refer to the group simply as "native-born." Note that the census asks respondents for their place of birth and citizenship status but does not ask whether persons are legal entrants to the United States.

TABLE 3

Demographic Change within Nativity Groups

	Citizen by Birth			Foreign-Born		
	1970	2000	Change (Percentage Points)	1970	2000	Change (Percentage Points)
A. Educational attainment						
Less than high school	51.5	19.7	-31.8	60.1	26.8	-33.3
High school	27.8	30.7	2.9	20.5	31.0	10.4
Some college	9.3	23.5	14.1	8.4	18.5	10.1
Bachelor's degree or higher	11.4	26.1	14.7	10.9	23.7	12.8
B. Race/ethnicity						
Non-Hispanic white	62.7	42.0	-20.7	69.9	22.9	-47.0
Non-Hispanic black	21.7	27.2	5.5	7.4	19.2	11.9
Non-Hispanic other	0.7	6.2	5.5	4.8	27.0	22.2
Hispanic, any race	14.9	24.6	9.7	18.0	30.9	12.9
C. Family status						
Husband-wife	68.6	46.0	-22.7	69.7	57.8	-11.9
Female-headed	15.7	25.0	9.3	8.8	16.7	7.9
Male-headed	3.1	4.8	1.7	3.4	7.1	3.6
Unrelated individual	12.5	24.2	11.7	18.0	18.4	0.4

Source: Authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census, 1970-2000.

driven by changes in the within-group poverty rates. In each period, the within-group rate effect nearly equals the actual increase in the poverty rate. This result suggests that demographic changes were occurring within both groups that made each group poorer. Looking at demographic shifts within the city's population by nativity (Table 3), we see that in fact both groups were experiencing similar changes in their demographic composition. Although native- and foreign-born New Yorkers alike increased their level of educational attainment (panel A), both groups were increasingly composed of racial groups with relatively high poverty rates (panel B). In addition, a rising share of each was made up of persons living in poverty-prone family status groups (panel C).

These results indicate that, rather than immigration per se, it is the demographic changes that cut across the native/immigrant divide that matter. This does not mean that immigration played no role in the evolution of poverty in New York. Immigration was indeed bringing to the city more people who are at risk of living in poverty. However, it is also clear that similar demographic shifts among the native-born population (who are still a majority of the city's residents) are no less important an influence on New York City poverty.¹⁵

Educational Attainment

In 1970, slightly more than one in ten city residents lived with a household head who had a bachelor's degree or higher level of educational attainment; by 2000, this share had increased to one in four (Table 4).¹⁶ In addition, the percentage of New Yorkers in a family headed by a person with some college, but not a bachelor's degree, increased from 9.1 to 21.6 percent. Thus, while only a little more than one in five city residents were members of a family headed by someone with at least some college in 1970, almost half were by 2000.

The decline in the percentage of the population living with a high-school dropout is almost the mirror image of this increasingly college-educated population. In 1970, more than half of all New Yorkers were in families headed by a high-school dropout; by 2000, this percentage had fallen to slightly more than one in five.

¹⁵As explained in footnote 12, our method abstracts from interactions among the variables. Thus, it does not, for instance, allow for the possibility that increased immigration might have an effect on native-born poverty.

¹⁶Since the calculation of whether or not an individual is in poverty is determined by family income, we use educational attainment of the household head in these calculations. Persons who are unrelated individuals, that is, not living in a family, are classified by their own educational attainment. They are treated as one-person families in this analysis.

TABLE 4

Decomposition of Change in Poverty Rate by Educational Attainment

	1969 Poverty Rate	1970 Population Share (Percent)	1979 Poverty Rate	1980 Population Share (Percent)	1999 Poverty Rate	2000 Population Share (Percent)
Less than high school	20.2	53.0	29.8	41.4	37.9	21.8
High school	9.8	26.6	17.2	29.2	25.1	30.9
Some college	7.1	9.1	12.9	13.0	17.4	21.6
Bachelor's degree or higher	4.4	11.3	6.9	16.4	8.4	25.6
Total	14.5	100.0	20.2	100.0	21.9	100.0

Memo:

1969-79

Demographic share effect	-1.6
Within-group rate effect	7.8
Interactive effect	-0.6
Actual change	5.7

1979-99

Demographic share effect	-3.8
Within-group rate effect	6.5
Interactive effect	-0.9
Actual change	1.8

Source: Authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census, 1970-2000.

TABLE 5

Decomposition of Poverty Rate by Family Status

	1969 Poverty Rate	1970 Population Share (Percent)	1979 Poverty Rate	1980 Population Share (Percent)	1999 Poverty Rate	2000 Population Share (Percent)
Husband-wife	7.6	69.9	10.2	58.7	13.7	51.4
Female-headed	37.3	14.7	45.9	20.4	37.2	22.5
Male-headed	11.1	3.2	16.8	3.4	18.3	5.7
Unrelated individual	27.2	12.1	24.2	17.5	27.0	20.3
Total	14.5	100.0	20.2	100.0	21.9	100.0

Memo:

1969-79

Demographic share effect	2.7
Within-group rate effect	2.9
Interactive effect	0.0
Actual change	5.7

1979-99

Demographic share effect	1.3
Within-group rate effect	0.8
Interactive effect	-0.3
Actual change	1.8

Source: Authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census, 1970-2000.

How are these large increases in educational attainment consistent with an overall increase in poverty, from 14.5 to 21.9 percent? Indeed, the decomposition results in Table 4 indicate that, all else equal, the rise in education should have led to declines in the city's poverty rate of 1.6 percentage points from 1969 to 1979 and 3.8 percentage points from 1979 to 1999. However, in both periods the rise in poverty rates within each group more than offset that effect.

The within-group effect was 7.8 percentage points in the earlier period and 6.5 percentage points in the latter period, reflecting the increase in poverty for all educational attainment groups during both periods. Not surprisingly, perhaps, the poverty rates for high-school dropouts and those with only a high-school degree rose dramatically over the period, from 20.2 to 37.9 percent for dropouts and from 9.8 to 25.1 percent for high-school graduates. More startling, however, are the

How are [New York City's] large increases in educational attainment consistent with an overall increase in poverty, from 14.5 to 21.9 percent?

increases in poverty for those groups with at least some college. The poverty rate rose from 7.1 to 17.4 percent among those with some college and from 4.4 to 8.4 percent among bachelor's degree holders.

Family Status

We define four mutually exclusive and collectively exhaustive family status categories: husband-wife, female-headed, male-headed, and unrelated individuals.¹⁷ In 1970, more than two-thirds of the city's population resided in husband-wife families; by 2000, this share had fallen to slightly more than half (Table 5). Persons living in female-headed families and as unrelated individuals—the family status groups with the highest poverty rates—picked up most of the corresponding gain. Consistent with national trends, most of the increase in female-headed families occurred during the 1970s.

These shifts in family status account for almost half of the upward movement in poverty from 1969 to 1979 (2.7 of

¹⁷ Female- and male-headed families are defined as those in which the person identified as the head of the household is not living with a spouse, but is living with at least one person to whom he or she is related. An "unrelated individual" household includes persons living alone (a majority) as well as those who are living with a roommate, friend, or domestic partner. They are treated as one-person families in this analysis.

5.7 percentage points) and roughly three-fourths of the increase from 1979 to 1999 (1.3 of 1.8 percentage points).

Once again, however, there has been within-group change that will also influence the overall poverty rate. In the first of the two periods, poverty rates rose for three of the four family

In 1970, more than two-thirds of the city's population resided in husband-wife families; by 2000, this share had fallen to slightly more than half.

status groups, resulting in a within-group effect that accounted for 2.9 of the 5.7 percentage point increase in the rate. In the latter period, the upward movement in poverty rates for three of the family status groups was offset by a sharp decline in the rate for persons living in female-headed families, resulting in a smaller within-group effect of 0.8 percentage point.

Race/Ethnicity

The racial and ethnic makeup of the city changed dramatically over the 1970-2000 period. In 1970, the city was 63.8 percent non-Hispanic white, 19.2 percent non-Hispanic black, and 15.6 percent Hispanic (Table 6). Only a negligible share (1.4 percent) fell outside these three categories. By 2000, Hispanics had replaced blacks as the second-most populous group in the city, and half of all New Yorkers identified themselves as either black or Hispanic. The fourth category, "non-Hispanic other" (primarily Asian), had grown from 1.4 to 13.8 percent of the population.¹⁸ These changes are, of course, mirrored by dramatic declines for whites, the only group to lose population share. Whites declined from almost two-thirds of the city's population in 1970 to slightly more than a third by 2000.

The poverty rate for whites in 1969, 8.4 percent, was the lowest of the four groups and 6 percentage points below the citywide average of 14.5 percent. The rate for Hispanics, 27.9 percent, was the highest among the four race/ethnicity groups, and the rate for blacks, 23.7 percent, was also substantially higher than the citywide average. All else equal, then, an increasingly black and Hispanic New York will also be a more impoverished New York.

Indeed, these shifts have the expected effect on the overall poverty rate, although the demographic share effect is rather modest in the 1969-79 period, accounting for only 1.9 of

¹⁸ We refer to these four groups as white, black, Hispanic, and other going forward.

TABLE 6

Decomposition of Poverty Rate by Race/Ethnicity

	1969 Poverty Rate	1970 Population Share (Percent)	1979 Poverty Rate	1980 Population Share (Percent)	1999 Poverty Rate	2000 Population Share (Percent)
Non-Hispanic white	8.4	63.8	9.8	51.7	12.1	35.0
Non-Hispanic black	23.7	19.2	29.6	24.0	25.3	24.1
Non-Hispanic other	16.2	1.4	15.8	3.9	20.9	13.8
Hispanic, any race	27.9	15.6	36.0	20.3	32.2	27.1
Total	14.5	100.0	20.2	100.0	21.9	100.0
Memo:						
1969-79						
Demographic share effect		1.9				
Within-group rate effect		3.3				
Interactive effect		0.5				
Actual change		5.7				
1979-99						
Demographic share effect		2.4				
Within-group rate effect		-0.5				
Interactive effect		-0.1				
Actual change		1.8				

Source: Authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census, 1970-2000.

the 5.7 percentage point increase.¹⁹ The much larger contribution of the within-group rate effect, 3.3 percentage points, was driven by the sharp rise in the poverty rate for blacks and Hispanics during the 1970s.

In the 1979-99 period, however, the demographic share effect (2.4 percent) overpredicts the 1.8 percentage point rise in the city poverty rate. This appears to be attributable to the considerable rise in the Hispanic share of New York's population, the group that suffers from the highest poverty rate. Over the same period, increases in poverty rates for whites and the burgeoning "other" (predominantly Asian) category were matched by poverty rate declines for blacks and Hispanics.²⁰

Finally, in Table 7, we look at the *combined* effects of shifts in race/ethnicity and family status, the two demographic

factors that our results indicate contribute positively to the increase in poverty in the 1969-79 period and its persistently high level from 1979 to 1999. The combined effect of shifts in the racial/ethnic and family status composition of the city in the 1969-79 period accounts for 4.3 of the 5.7 percentage point rise in poverty. In the 1979-99 period, the demographic share effect (3.5 percentage points) overpredicts the actual (1.8 percentage point) rise in poverty. Evidently, the changing family status and racial/ethnic composition of the city's population offset any positive effect that rising levels of educational attainment might have had on the city poverty rate. However, as we discuss in the next section, these demographic shifts were occurring in an economic context that also had an impact on poverty.

¹⁹ Much of the difference in poverty rates by race and ethnicity can be associated with differences in educational attainment and family status. For example, for New York City in 1999, the poverty rate was 12.1 percent for whites and 25.3 percent for blacks, a 13.2 percentage point difference. If we compute a hypothetical black poverty rate using the distribution of the white population by education and family status and the poverty rates for blacks for each family status by education groups, the black poverty rate would be 17.5 percent. This scenario reduces the black/white difference to 4.2 percentage points and suggests that differences in education and family status account for more than 68 percent of the difference in poverty between blacks and whites.

²⁰ The 2000 census featured a major redefinition of racial categories by permitting respondents to describe themselves as members of more than one racial group. Most New Yorkers who did so were Hispanic and are therefore placed in that category. Those non-Hispanic New Yorkers who identified themselves as multiracial are included in the "non-Hispanic other" category.

TABLE 7

Decomposition of Poverty Rate by Family Status and Race/Ethnicity

	1969 Poverty Rate	1970 Population Share (Percent)	1979 Poverty Rate	1980 Population Share (Percent)	1999 Poverty Rate	2000 Population Share (Percent)
Non-Hispanic white						
Husband-wife	4.4	47.6	6.0	34.0	9.3	20.5
Female-headed	17.1	5.4	19.3	5.0	17.4	3.2
Male-headed	4.9	2.0	6.8	1.5	11.2	1.2
Unrelated individual	25.0	8.8	17.6	11.2	16.1	10.1
Non-Hispanic black						
Husband-wife	11.1	10.8	13.5	10.7	11.4	8.9
Female-headed	45.8	5.5	48.1	8.6	35.2	9.5
Male-headed	14.0	0.7	22.9	1.0	18.6	1.5
Unrelated individual	33.4	2.1	35.4	3.8	34.8	4.3
Non-Hispanic other						
Husband-wife	10.6	1.1	12.0	3.0	18.0	9.4
Female-headed	46.3	0.1	34.2	0.3	24.9	1.5
Male-headed	19.6	0.1	18.0	0.1	19.0	0.9
Unrelated individual	34.2	0.2	27.1	0.4	32.6	2.0
Hispanic, any race						
Husband-wife	18.2	10.5	19.6	11.0	19.2	12.6
Female-headed	54.2	3.7	64.5	6.4	49.1	8.4
Male-headed	30.1	0.5	27.8	0.8	21.8	2.1
Unrelated individual	32.1	0.9	38.3	2.1	43.4	3.9
Total	14.5	100.0	20.2	100.0	21.9	100.0
Memo:						
1969-79						
Demographic share effect	4.3					
Within-group rate effect	1.3					
Interactive effect	0.1					
Actual change	5.7					
1979-99						
Demographic share effect	3.5					
Within-group rate effect	-1.3					
Interactive effect	-0.4					
Actual change	1.8					

Source: Authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census, 1970-2000.

3. SECULAR CHANGE IN THE ECONOMIC ENVIRONMENT: THE EFFECTS OF INCOME GROWTH AND INEQUALITY

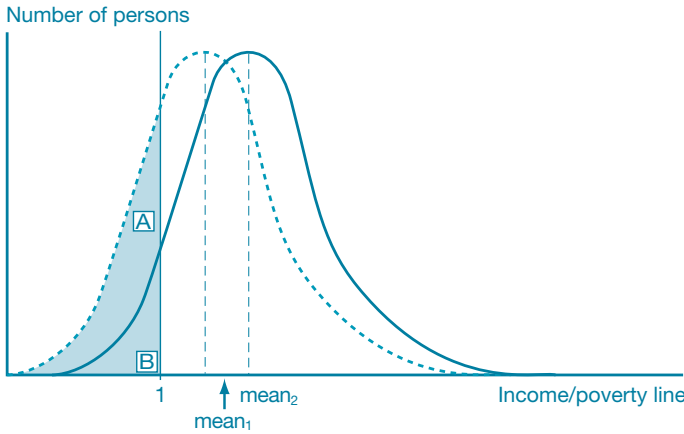
Absent from our account thus far is the effect of the economic environment in which demographic changes occur. During economic expansions, for example, the poverty rate generally declines as employment grows and earnings and family incomes rise. In recessions, the poverty rate generally rises. In this study, however, we are interested in differences in the

poverty rate that control for these cyclical effects. Fortunately, the decennial census data lend themselves to an exploration of secular change because the years they cover—1969, 1979, 1989, and 1999—correspond closely to business cycle peaks. Across similar phases in the business cycle, therefore, we can measure the influence on the poverty rate not only of income growth but also of changes in income inequality.

To preview our results, when we add these economic factors it becomes clear that the decline in mean income from 1969 to 1979 contributed to the increase in the poverty rate during this

EXHIBIT 1

Effect on the Poverty Rate of an Equally Shared Increase in Real Income



Source: Danziger and Gottschalk (1993).

period. Its impact over the period, however, was less influential than the combined impact of the shift in the city's racial composition and the change in family status. In the 1979-99 period, however, a renewal of income growth did not translate into a decline in poverty. While demographic changes offset some of the effect of income growth, their influence is modest relative to the contribution of rising income inequality.

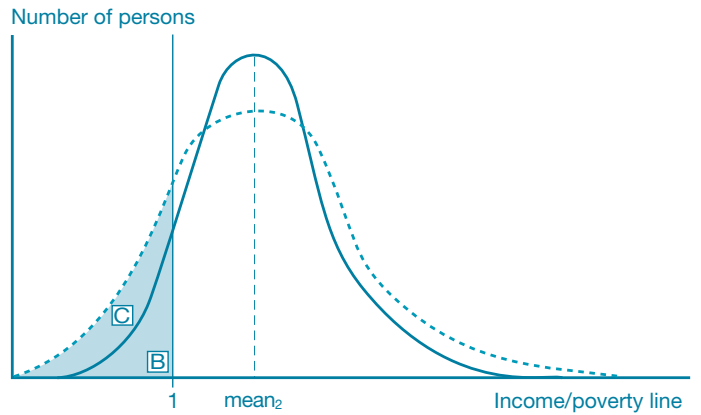
Our empirical strategy begins with the recognition that given a fixed poverty threshold, any equally shared increase in real income must lead to a fall in the poverty rate, because the increase will push some people above the threshold. This relationship is illustrated in Exhibit 1: equally shared increases in real income shift the entire income distribution to the right. Before the shift, the entire shaded area (segments A and B combined) lies below the poverty threshold (labeled "1"); after the shift, only segment B lies below the threshold.

Increases in income inequality (assuming a constant mean income) will generally have the opposite effect. As shown in Exhibit 2, increases in inequality (assuming they occur at least in part in the lower tail of the distribution) will raise the proportion of the population in poverty, in this case from segment B to segments B and C combined.²¹ Thus, along with demographic factors, we can think of changes in the poverty rate over time as the result of two economic factors—those associated with income growth (or lack thereof) and those associated with changes in income inequality.

²¹ It is possible for inequality to increase in the lower tail of the distribution without a concomitant rise in the poverty rate. For instance, if the population in poverty at time t became poorer still in time $t + 1$, but no new individuals fell below the threshold, inequality would increase and the poverty rate would remain the same.

EXHIBIT 2

Effect on the Poverty Rate of an Increase in Income Inequality



Source: Danziger and Gottschalk (1993).

We introduce the effect of income growth and changes in income inequality into our analysis of the New York City poverty rate by employing a decomposition analysis utilized by Danziger and Gottschalk (1993) and Iceland (2003). We construct two hypothetical poverty rates that allow us to quantify the contribution of income growth, demographic change, and income inequality to the change in the poverty rate from an initial year to a second year.

Hypothetical poverty rate 1: This hypothetical poverty rate simulates a "year two" poverty rate for the city under the assumption that the rate of mean income growth from year one to year two had been spread evenly across families (and unrelated individuals) and therefore by demographic groups. Continuing with the notation used in equations 1-5, we observe that:

$$(6) \quad \text{hypothetical poverty rate 1} = \sum_{i=1}^N \hat{R}_{i2} * S_{i1},$$

where $\hat{R}_{i2}$ is the "hypothetical poverty rate 1" for each demographic group i in year two.

The hypothetical poverty rate holds constant both the demographic composition of the population and the distribution of income.

Hypothetical poverty rate 2: This hypothetical poverty rate simulates the year two poverty rate for New York as if income growth had been equally shared and the demographic composition of the population had undergone its actual change.

$$(7) \quad \text{hypothetical poverty rate 2} = \sum_{i=1}^N \hat{R}_{i2} * S_{i2}.$$

We can use these hypothetical poverty rates to decompose the difference between the actual poverty rates in years one and two into the sum of differences attributable to changes in: 1) income growth, 2) demographic composition, and 3) inequality.

The difference between the actual poverty rates in years one and two is:

$$(8) \quad \text{poverty rate year 2} - \text{poverty rate year 1}$$

$$= \sum_{i=1}^N R_{i2} * S_{i2} - \sum_{i=1}^N R_{i1} * S_{i1}.$$

This difference is equal to the sum:

$$(9) \quad \sum_{i=1}^N \hat{R}_{i2} * S_{i1} - \sum_{i=1}^N R_{i1} * S_{i1}$$

$$(10) \quad + \sum_{i=1}^N \hat{R}_{i2} * S_{i2} - \sum_{i=1}^N \hat{R}_{i2} * S_{i1}$$

$$(11) \quad + \sum_{i=1}^N \hat{R}_{i2} * S_{i2} - \sum_{i=1}^N \hat{R}_{i2} * S_{i2},$$

where the first term (equation 9) is the income growth effect, the second term (equation 10) is the demographic change effect, and the third term (equation 11) is the income inequality effect. Since we have direct measures of demographic change and income growth, the income inequality effect is a residual term, picking up the influence of factors other than those controlled for in the demographic change and income growth effects.

Using this methodology, we break down the change in the city poverty rate from 1969 to 1979 and from 1979 to 1999 (Table 8) into changes produced by the change in mean income, the changes in race and family status, and the change in income inequality. Box 3 provides details on the mechanics of these calculations. For the 1969-79 period, the fall in mean income accounts for 3.1 of the 5.7 percentage point rise in the poverty rate. Race and family status have a somewhat larger impact, contributing 4.9 percentage points to the rise in poverty. Because the sum of these two effects exceeds the actual rise in poverty, the income inequality effect must by construction be negative and equal to -2.4 percentage points. This implies that the distribution of income became more equal over this period and that, all else constant, it would have produced a decline in the poverty rate.²²

²² By one measure—one that is key to changes in poverty rates—the income distribution did become more equal; from 1969 to 1979, the ratio of family income at the 50th-10th deciles fell from 4.9 to 4.2.

TABLE 8

Decomposition of Change in Poverty Rates

Change from 1969 to 1979	
Actual poverty rate, 1969	14.5
Actual poverty rate, 1979	20.2
Actual change	5.7
Hypothetical poverty rate 1	17.6
Hypothetical poverty rate 2	22.5
Income growth effect	3.1
Demographic change effect	4.9
Income inequality effect	-2.4
Total change in poverty rate	5.7
Change from 1979 to 1999	
Actual poverty rate, 1979	20.2
Actual poverty rate, 1999	21.9
Actual change	1.8
Hypothetical poverty rate 1	13.1
Hypothetical poverty rate 2	15.6
Income growth effect	-7.0
Demographic change effect	2.5
Income inequality effect	6.4
Total change in poverty rate	1.8

Source: Authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census, 1970-2000.

In the 1979-99 period, income growth resumed. Without any offsetting factors, the rise in median income would have resulted in an impressive 7.0 percentage point fall in the poverty rate. As expected, the income growth effect was partially offset by demographic change, which would have led to a 2.5 percentage point rise in poverty. However, the rise in income inequality plays a much more important role than demographic change during this period; its impact equals 6.4 percentage points.

Thus, bringing income growth and income inequality into the decomposition diminishes the relative contribution of the demographic effect. This stems from an important difference in the question addressed in the two decompositions. The decompositions in Tables 1-7 address how much of the actual change in poverty is associated with the change in the demographic composition of the city, thereby allowing for an identification of key demographic changes. Once the key demographic changes are identified, the analysis uses the decompositions in Table 8 to answer a more critical question: How much did demographic change and an increase in inequality offset what should have been a sharp decline in

Calculating the Income Growth and Income Inequality Effects

The top panel of Table 8 ascribes to the income growth effect 3.1 of the 5.7 percentage point growth in the poverty rate from 1969 to 1979. We calculate this effect by taking the difference between a hypothetical poverty rate for 1979 (labeled “hypothetical poverty rate 1”) and the actual poverty rate in 1969. (See equation 9, recalling that $\hat{R}_{i2}$ is the “hypothetical poverty rate 1” for each demographic group i in year two.) Hypothetical poverty rate 1 is calculated by adjusting each person’s family income in the 1970 census microdata file by the citywide change in mean family income from 1969 to 1979. From the decennial census microdata, we estimate that mean family income (after adjusting for the change in the consumer price index) in 1979 was equal to 88.4 percent of its 1969 level. When we apply this decline in family income across the observations in the 1970 microdata file, we see that the citywide poverty rate climbs from 14.5 percent to a hypothetical poverty rate 1 of 17.6 percent. The difference between these two rates, 3.1 percentage points, represents the increase in the poverty rate that we would have obtained if the actual decline in mean income over the decade had been equally shared across the population.

Hypothetical poverty rate 2 adds the effect of demographic change to the effect of income growth. This hypothetical rate is created in two steps. First, we calculate poverty rates for each of the demographic groups from the 1970 census microdata file using the downwardly adjusted family income employed to compute the income growth effect. Second, we calculate a citywide poverty rate by summing the products of these poverty rates by demographic group and each group’s respective share of the city population in 1980. This results in a (hypothetical) poverty rate 2 of 22.5 percent. (The rate is higher than hypothetical poverty rate 1 because demographic groups with above-average poverty rates increased their population shares between 1969 and 1979.) Thus, the 4.9 percentage point difference between hypothetical poverty rates 1 and 2 is the demographic change effect.

The income inequality effect is the residual calculated as the difference between the actual change in the poverty rate from 1969 to 1979 and the proportion of the change that is underestimated (or overestimated) by the income growth and demographic change effects. In this instance, it equals (after rounding) -2.4 percentage points ($20.2 - (14.5 + 3.1 + 4.9)$).

The bottom panel of Table 8 presents the results of this exercise for the 1979-99 period.

poverty between 1979 and 1999 attributable to the rise in mean income? According to the decomposition of poverty for those years, the effect of inequality was much greater than the effect of demographic change.

4. EXPLORING INEQUALITY: EMPLOYMENT, EARNINGS, AND INCOME

Our analysis assigns an important role to income inequality; methodologically, it is a residual, a measurement of what is left over after other factors have been accounted for. In this section, we look inside that “black box.” Following the literature cited earlier, we focus on the role of changes in employment and earnings on trends in income inequality and poverty. Because growing inequality figures so prominently in the stability of the poverty rate from 1979 to 1999, we restrict our attention to changes between those years. Initially, we limit the scope of our analysis to a group we refer to as the “non-elderly population,” defined as unrelated individuals under sixty-five and members of families headed by a person younger than sixty-five. This group, which we would expect to be most dependent on income derived from employment, accounted for 85.9 percent of the total city population in 2000.

We find that the poverty rate for the non-elderly population edged up from 21.2 to 22.4 percent from 1979 to 1999. The increase occurred despite higher levels of work activity, measured by annual weeks worked per family. When we narrow our focus further to the non-elderly population with “full-year” levels of work, we find a 3.1 percentage point rise in the poverty rate. Trends in earnings and income among the full-year working families by educational attainment exhibit a clear pattern of growing inequality driven by changes in earnings per week worked. This growth in earnings inequality appears to be a major source of the rise in income inequality that was responsible for the 1979-99 increase in the poverty rate.

4.1 More Poverty Despite More Work

Changes in levels of employment are a factor that our exploration of poverty has thus far omitted. In this section, we consider this factor by looking at work activity per family.²³ We divide the city’s non-elderly population into three groups according to the total number of weeks worked per year by all family members eighteen and older: those with

²³ Recall that unrelated individuals are treated as a family of one.

TABLE 9

Poverty Rates and Population Shares of Non-Elderly Population, by Weeks Worked

	1979		1999		Percentage Point Change	
	Poverty Rate	Population Share (Percent)	Poverty Rate	Population Share (Percent)	Poverty Rate	Population Share
No work	77.7	15.6	80.6	12.0	2.9	-3.7
Less than full year	34.5	14.4	40.8	15.4	6.3	1.0
Full year	5.8	70.0	8.9	72.6	3.1	2.6
Total	21.2	100.0	22.4	100.0	1.3	NA

Source: Authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census, 1980 and 2000.

Note: Weeks worked are measured for the calendar year prior to the census.

no weeks worked, those with one to forty-nine weeks worked (labeled in Table 9 as "less than full year"), and those with fifty or more weeks worked (labeled "full year").²⁴

From 1979 to 1999, the percentage of the non-elderly population living in families engaged in work increased. Most notably, the full-year category rose from 70.0 to 72.6 percent of the population. Over the same period, however, the poverty rate increased in each work activity group. What would have been a 2.3 percentage point decline in the population-wide poverty rate attributable to the rising share of persons living in working families was more than offset by the within-group poverty rate increases.²⁵ As a result, the poverty rate for the entire non-elderly population edged up by 1.3 percentage points. Of greatest relevance to the general rise in poverty among the non-elderly (owing to their large share of the population) was the 3.1 percentage point increase in the poverty rate for persons living in full-year working families.

4.2 Growing Earnings Inequality among Full-Year Working Families

The large and growing share of persons living in non-elderly, full-year working families along with the marked rise in poverty for this group invites closer scrutiny. Given the now vast literature documenting the rise in earnings inequality by level of education, we summarize trends in earnings, weeks

²⁴ We use weeks worked per year per family because poverty is measured at the family, rather than at the individual, level. Since there may be a mix of full- and part-time workers in each family, the usual distinction between full- and part-time work does not apply.

²⁵ This estimate is based on a decomposition calculation similar to those reported in Tables 2-6.

TABLE 10

Earned Income as a Share of Total Income for Persons Living in Full-Year Working Families

	1979	1999
Less than high school	91.5	91.8
High school	93.7	93.2
Some college	94.5	93.5
Bachelor's degree or higher	96.9	92.4
Total	94.1	92.8

Source: Authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census, 1980 and 2000.

worked, and wage rates for this group of families through the lens of educational attainment of the family head. The salience of these earnings trends to total family income—and, by extension, poverty—is evident from Table 10, which shows that earned income was a high (more than 90 percent) and stable share of total family income across the educational spectrum.²⁶

Table 11 depicts annual earnings, weeks worked, and weekly earnings for 1979 and 1999. The pattern of change it reveals is one of rising annual earnings inequality driven by growing inequality in weekly earnings. Panel A reports median annual family earnings (in 1999 dollars) by educational attainment for 1979 and 1999. As the panel shows, although median annual earnings rose 8.9 percent population-wide, the less-educated individuals suffered declines. Real earnings for those with less

²⁶ Earned income is income derived from employment either as wages or salaries or as proprietors' income for the self-employed.

TABLE 11

Family Earnings by Education for Full-Year Working Families

	1979	1999	Percentage Change
A. Median annual earnings			
Less than high school	36,946	35,000	-5.3
High school	44,828	42,000	-6.3
Some college	47,938	50,000	4.3
Bachelor's degree or higher	60,605	71,000	17.2
Total	45,907	50,000	8.9
B. Median weeks worked per year			
Less than high school	77	88	11
High school	72	82	10
Some college	65	78	13
Bachelor's degree or higher	62	76	14
Total	71	80	9
C. Median weekly earnings			
Less than high school	460	392	-14.7
High school	565	514	-9.1
Some college	629	621	-1.3
Bachelor's degree or higher	828	920	11.0
Total	574	603	5.1

Source: Authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census, 1980 and 2000.

Note: Earnings are expressed in 1999 dollars.

than a high-school education and only a high-school education fell 5.3 percent and 6.3 percent, respectively. In contrast, those with some college education and a bachelor's degree or higher saw earnings increase 4.3 percent and 17.2 percent, respectively.

The decline in earnings for the less-educated groups was not a result of fewer weeks worked. As panel B of Table 11 reports, all of the educational attainment groups increased their median weeks worked per year from 1979 to 1999.²⁷ (Recall that this is the median of total weeks worked by all members of full-year working families eighteen and older.) The disparate patterns of changes in earnings and weeks worked is reflected in panel C, which reports median weekly earnings (total earnings per family divided by total weeks per family). The decline in these wage rates is more widespread and dramatic than the decline

²⁷ Interestingly, the number of weeks worked for the less-educated groups is somewhat higher than it is for the more educated groups. In 1999, for example, median weeks worked for those with less than a high-school education was eighty-eight per family, compared with seventy-six per family for those with a bachelor's degree or higher.

TABLE 12

Income Inequality among Persons Living in Full-Year Working Families Percentages of the Poverty Threshold

	1979	1999	Change
A. Ratio of Total Earned Income to Poverty Threshold			
Percentile			
10	111	94	-17
20	162	145	-17
30	204	193	-11
40	247	243	-4
50	290	297	7
60	341	359	18
70	396	428	32
80	456	485	29
90	497	501 ^a	NA
50/10 ratio	2.61	3.16	21.2
B. Ratio of Total Family Income to Poverty Threshold			
Percentile			
10	126	107	-19
20	177	160	-17
30	222	211	-11
40	266	264	-2
50	315	325	10
60	368	394	26
70	432	482	50
80	501 ^a	501 ^a	NA
90	501 ^a	501 ^a	NA
50/10 ratio	2.50	3.04	21.5

Source: Authors' calculations, based on the 5-Percent Public Use Microdata Sample Files of the U.S. Census Bureau's decennial census, 1980 and 2000.

^aRatios are top-coded at 501.

in median annual earnings, indicating that increased weeks worked offset some of the decline in earnings per week.²⁸ Thus, declines in earnings per week drove the fall in annual earnings for the less-educated groups and resulted in an expansion of earnings inequality between the more and less-educated groups.

To be associated with the growth in poverty, the growth in earnings inequality must find its reflection in an expansion of the lower tail of the income-to-poverty threshold ratio distribution.²⁹ The effect of expanding earnings inequality on

²⁸ This impressive rise in annual weeks worked per family is also evident in national-level data (see, for example, Mishel, Bernstein, and Allegretto [2007]).

²⁹ Recall from Section 3 the role of the expanded distance between the mean and lower tail of the income-to-poverty threshold distribution.

total income inequality and the growth of poverty among the city's full-year working families is illustrated in Table 12. Panel A reports the ratio of earned income to the poverty threshold (as a percentage) at deciles of the income-to-poverty threshold distribution. Panel B reports the ratio of total family earned income to the poverty threshold in a similar manner. Given earned income's large share of total income, it is hardly surprising that changes in the two ratios from 1979 to 1999 are quite similar. In both cases, there is a modest rise in the ratio at the median (50th percentile) of the distribution. Above the median, increases in the ratios rise with each decile until top-coding of the Census Bureau's income data prevents the measurement of further increases. Below the median, declines in the ratios from 1979 to 1999 grow more severe toward the lower tail of the distribution.

This pattern of change makes evident the increased income inequality that apparently drove a larger fraction of the lower tail of the income distribution below 100 percent of the federal poverty line. Because inequality between the median and the lower tail of the distribution is most relevant to trends in poverty, we measure the growth in inequality as the percentage change in the ratio of the 50th-10th income decile. By this criterion, dispersion rose 21.2 percent for earned income and 21.5 percent for total income.

In sum, we find a considerable expansion of earnings inequality within a major segment of the city's population—persons living in full-year working families. The expansion of earned income inequality is pervasive and appears to be a driving force behind the growth of income inequality. These labor market outcomes, it would seem, played an important role in preventing income growth from translating into poverty rate declines from 1979 to 1999 and in perpetuating New York City's high poverty rate.

5. CONCLUSION

Over the 1979-99 period, New York City enjoyed considerable gains in employment, income, and educational attainment. The poverty-reducing effects of these developments, however, were offset in part by a rising share of the city's population in poverty-prone groups such as blacks, Hispanics, and families headed by single women. Dwarfing the impact of these demographic changes was a dramatic increase in income inequality driven by a widening disparity in wage rates.

The promotion of work and marriage has become the mainstream solution to poverty in America (see, for example, Haskins and Sawhill [2003]). Our findings indeed support the view that fewer New Yorkers would be poor if more of them lived in working, two-parent families. The rate of single parenthood is higher in New York City than it is nationwide, making the phenomenon especially relevant to the city. However, our study also suggests that any comprehensive effort to address poverty in New York, and the nation, cannot ignore the need for labor market policies that raise earnings for workers on the lower rungs of the wage ladder. Local policymakers could consider a continued expansion of tax programs that supplement earnings, such as the state and city earned income tax credits. Increasing the availability of subsidized childcare would also make work more rewarding by defraying the costs of holding a job.

Furthermore, New York State can maintain the purchasing power of its \$7.15 minimum wage by indexing it to the annual rise in the cost of living. We believe that modest yearly increases in the minimum wage would be preferable to the decades-old, politically driven pattern of stagnation followed by spikes in the value of the wage floor.

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WHY THE U.S. TREASURY BEGAN AUCTIONING TREASURY BILLS IN 1929

- In the 1920s, there were several flaws in the structure of U.S. Treasury financing operations.
- The flaws were attributable to the war-time practice of selling securities in fixed-price subscription offerings and the newer practice of limiting Treasury debt sales to quarterly dates.
- In 1929, the Treasury introduced a new financial instrument to mitigate these flaws.
- Treasury bills were auctioned rather than offered for sale at a fixed price and were sold on an as-needed basis instead of on a quarterly schedule.
- By introducing a new class of securities, the Treasury was able to address the defects in the existing primary market structure even as it continued to maintain that structure.

1. INTRODUCTION

The introduction of a new financial instrument by a sovereign issuer is never a trivial event. New instruments require the development of marketing programs and accounting systems, consume disproportionate amounts of senior executive time, and not infrequently require new statutory authority. It is hardly surprising that the United States has introduced only a handful of new instruments since the development of a liquid, national market for Treasury securities during World War I, including savings bonds, STRIPS, foreign-targeted Treasury notes, and TIPS (Box 1).

This article examines the U.S. Treasury’s decision to introduce a new financial instrument—Treasury bills—in 1929. We show that Treasury officials were willing to commit the resources required to introduce the new security in order to mitigate several flaws in the structure of Treasury financing operations, such as:

- *New debt offerings were chronically oversubscribed.* Reliance on fixed-price subscription offerings of new debt during the 1920s resulted in chronic oversubscriptions, a clear indication that the offerings were persistently underpriced.
- *The schedule for new debt sales resulted in negative “carry” on Treasury cash balances at commercial banks.* The Treasury sold new debt only four times a year—on tax

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Box 1

New Financial Instruments Introduced by the U.S. Treasury after 1918

Savings Bonds

Single-payment, intermediate-term non-marketable securities with fixed-price redemption options. Introduced in March 1935.

Separate Trading of Registered Interest and Principal of Securities (STRIPS)

Single-payment securities derived by separating the principal and interest payments bundled together in conventional Treasury notes and bonds. Introduced in February 1985.

Foreign-Targeted Treasury Notes

Notes providing for limited disclosure of ownership when owned by “United States Aliens.”^a Four foreign-targeted notes were sold between October 1984 and February 1986.

Treasury Inflation-Protected Securities (TIPS)

Coupon-bearing notes and bonds with principal and interest payments indexed to the consumer price index. Introduced in January 1997.

^aA United States Alien is defined as a foreign corporation, nonresident alien individual, nonresident alien fiduciary of a foreign estate or trust, and certain related foreign partnerships. Treasury Circular no. 31-84, October 10, 1984, and Garbade (1987).

payment dates—and was consequently forced to borrow in advance of its needs and to inventory the proceeds in commercial bank accounts that earned interest at a rate lower than that paid by the Treasury on its indebtedness, resulting in negative carry on the account balances.

- *The Treasury had to arrange short-term loans from Federal Reserve Banks to make maturity payments.* Treasury officials set new issues to mature on tax payment dates. This schedule forced the Treasury to borrow from the Federal Reserve to bridge the gap between the date it needed to make a maturity payment and the date it actually collected tax receipts—typically several days after the stated due date. The short-term Reserve Bank loans sometimes created transient fluctuations in reserves available to the banking system and undesirable volatility in overnight interest rates.

We begin by describing in Section 2 the structure of Treasury financing operations in the mid-1920s and explaining how that structure had evolved in support of an important objective of federal fiscal policy: paying down, as expeditiously as possible, the debt incurred in the course of financing World War I. Section 3 describes the flaws in the structure of Treasury financing operations, and Section 4 shows how Treasury

officials planned to correct or mitigate the flaws with Treasury bills. The evolution of bill financing in the early 1930s is described briefly in Section 5. Section 6 concludes.

2. TREASURY FINANCING OPERATIONS IN THE MID-1920S

The two principal objectives of federal fiscal policy in the 1920s were tax reduction and paying down the war debt. In mid-1914, there was only \$968 million of interest-bearing Treasury debt outstanding; by mid-1919, the debt had ballooned to \$25.2 billion.¹ Over the same period, the maximum tax rate on personal income had increased from 7 percent to 77 percent.²

Political leaders recognized that the tax system had become badly warped in the haste of responding to wartime requirements. In his 1919 State of the Union message, President Woodrow Wilson suggested that

Congress might well consider whether the higher rates of income and profits taxes can in peace times be effectively productive of revenue, and whether they may not, on the contrary, be destructive of business activity and productive of waste and inefficiency. There is a point at which in peace times high rates of income and profits taxes discourage energy, remove the incentive to new enterprise, encourage extravagant expenditures, and produce industrial stagnation.³

President Wilson’s first post-war Secretary of the Treasury, Carter Glass, argued that the tax system encouraged “wasteful expenditure,” penalized “brains, energy, and enterprise,” and discouraged new ventures.⁴ Promptly after being sworn in as President on March 4, 1921, Warren Harding called a special session of the Congress to reduce personal and corporate taxes.⁵

Despite the intense interest in tax reduction, there was near-universal agreement that taxes should not be cut to levels that would impede expeditious debt reduction. In his address to

¹1914 Treasury Annual Report, p. 46, and 1919 Treasury Annual Report, p. 186.

²Underwood-Simmons Tariff Act, October 3, 1913, 38 Stat. 114, and Revenue Act of 1918, February 24, 1919, 40 Stat. 1057.

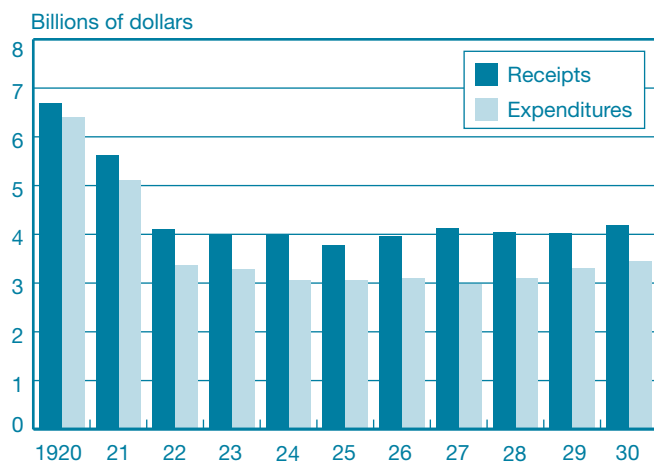
³“Text of President Wilson’s Message to Congress, Urging Return to Peace Basis,” *New York Times*, December 3, 1919, p. 6.

⁴1919 Treasury Annual Report, p. 23.

⁵“Harding Will Call Special Session for April 4 or 11,” *New York Times*, March 8, 1921, p. 1, and “President to Call Congress April 11,” *New York Times*, March 15, 1921, p. 1. See also “President’s Address to Congress on Domestic and Foreign Policies,” *New York Times*, April 13, 1921, p. 7 (quoting Harding’s comment that “The most substantial relief from the tax burden must come for the present from the readjustment of internal taxes, and the revision or repeal of those taxes which have become unproductive and are so artificial and burdensome as to defeat their own purpose.”), and Smiley and Keehn (1995, p. 287) (by 1920, “Both Democrats and Republicans believed that . . . tax avoidance had reduced the revenue collected from the wealthiest Americans . . .”).

CHART 1

Treasury Receipts and Expenditures (Other Than for Debt Retirement), Fiscal Year 1920 – Fiscal Year 1930



Source: Treasury annual reports.

the special session of the Congress in 1921, President Harding announced a policy of “orderly funding and *gradual liquidation*” of the debt.⁶ Three years later, in the course of arguing for a second round of tax cuts, Secretary of the Treasury Andrew Mellon cautioned that “the Government must always be assured that taxes will not be so far reduced as to deprive the Treasury of sufficient revenue with which properly to run its business . . . and to take care of the debt.”⁷ Debt reduction, Secretary Mellon claimed, was “the best method of bringing about tax reduction. Aside from gradual refunding at lower rates of interest, it is the only method of reducing the heavy annual interest charges.”⁸

Remarkably, the federal government was able to reduce both tax rates and the national debt in the 1920s. In a series of three revenue measures adopted between 1921 and 1926, the Congress reduced tax rates on personal income to a maximum of 25 percent.⁹ Treasury receipts fell from their high-water

⁶ “President’s Address to Congress on Domestic and Foreign Policies,” *New York Times*, April 13, 1921, p. 7. Emphasis added. Cannadine (2006, p. 278) describes Harding’s economic agenda as a restoration of “the prewar climate of low taxes, balanced budgets, manageable national debt, limited government, and a functioning international economy backed by the gold standard.”

⁷ Mellon (1924, p. 20). Emphasis added.

⁸ 1924 Treasury Annual Report, p. 26. Mellon reiterated his view of the link between debt reduction and tax reduction in 1926: “As long as there are enormous fixed debt charges . . . no large reduction in total expenditures is possible. . . . [T]he more rapidly the debt is retired, the sooner will come the time when these charges can be practically eliminated.” 1926 Treasury Annual Report, pp. 33-4.

mark of \$6.75 billion in fiscal year 1920 to \$4 billion in 1922 in the wake of a severe post-war recession, but then leveled off—and even rose a bit in the second half of the decade—as a result of rapidly expanding economic activity. At the same time, the Congress was able to effect significant expenditure reductions. The result was a budget surplus in every fiscal year from 1920 to 1930 (Chart 1). The surpluses underwrote a 37 percent reduction in Treasury indebtedness—to \$16 billion by the end of the decade.

Despite the intense interest in tax reduction, there was near-universal agreement that taxes should not be cut to levels that would impede expeditious debt reduction.

To understand how the Treasury structured its financing operations to support the goal of debt reduction, we first have to understand how the war was financed.

2.1 Financing World War I

The entry of the United States into World War I, on April 6, 1917, set off a prolonged national debate over whether the war should be financed with debt or taxes. Some, like Senator Furnifold Simmons of North Carolina, took a position at the debt end of the spectrum: “It has been the custom of this country to pay war bills by bond issues, and I see no reason for a change in that policy.”¹⁰ The nation’s most prominent financier, J. P. Morgan, believed that no more than 20 percent of war expenses should be paid from taxes; President Wilson’s wartime Secretary of the Treasury, William McAdoo, thought half was preferable.¹¹ Further along the spectrum, the *New York Times* reported that “some members of Congress are advocating the raising of 75 per cent of the first year needs by taxation,” and leading economists at forty-three colleges and universities signed a petition urging taxation as the principal means of finance.¹²

The central issue was whether debt could transfer the burden of the war to future generations. Economists agreed that it could—if the debt were sold to foreigners.¹³ In that case, the war might require little sacrifice in current living standards.

⁹ See Blakey (1922, 1924, and 1926), Smiley and Keehn (1995), Murnane (2004), and Cannadine (2006, pp. 287-8 and 313-8).

¹⁰ Quoted in Adams (1917, p. 292).

The debt would have to be repaid, but repayment would be funded from taxes imposed on later generations. However, since there were no other countries from which to borrow in 1917 (Japan was the only major country not already involved in the conflict), there was no essential difference—from an aggregate point of view—between debt financing and tax financing. Either way, the entire cost of the war had to be borne immediately, by Americans, in the form of reduced consumption.¹⁴

Economists also agreed that debt financing and tax financing differed at a *disaggregated* level and that debt financing facilitated intertemporal reallocations of the burdens of war among individuals. Roy Blakey, an economist at the University of Minnesota, observed that “when a war comes

The Treasury raised \$21.5 billion during the war by floating five enormous Liberty loans; it also raised additional sums with monthly—sometimes biweekly—sales of short-term certificates of indebtedness.

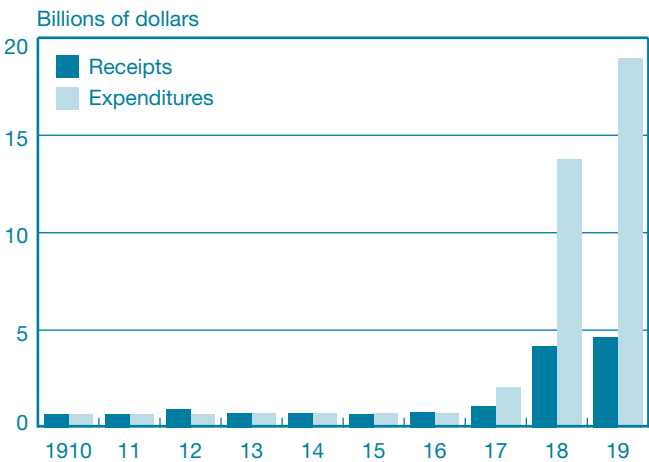
unexpectedly it may find many individuals unprepared to pay their just shares of a new and large burden. It may be best all around to permit some to assume the burden of others temporarily, either wholly or in part.”¹⁵ Blakey appreciated that individuals as well as governments can borrow, but he concluded that there were good reasons to prefer public, rather than private, finance: “In so far as the government can make easier advantageous credit transactions by itself assuming the borrowing agency instead of leaving the transactions to be arranged through individuals, there is a further net gain.”¹⁶

¹¹ Morgan’s view is reported in McAdoo (1931, p. 383). For McAdoo, see “Senate Will Pass Bond Bill Quickly,” *New York Times*, April 13, 1917, p. 3 (“McAdoo believes that about half the expenses of the war should be paid from current revenues....”), McAdoo (1931, p. 372) (“I hoped to raise about half of the expenditures through taxes.”), and the April 14, 1917, letter from McAdoo to Cleveland H. Dodge, a prominent philanthropist and Princeton classmate of Woodrow Wilson, quoted in Synon (1924, pp. 222-3) (“As to taxation, my feeling has been that fifty per cent of the cost of the war should be financed by it.”). McAdoo later revised his thinking to one-third taxes and two-thirds debt. See his letter to the chairman of the House Ways and Means Committee quoted in “McAdoo Advises Doubling War Tax,” *New York Times*, June 7, 1918, p. 1 (“I believe that if we are to preserve the soundness and stability of our financial system, we should raise by taxation not less than one-third of the estimated expenditures for the fiscal year 1919....”).

¹² “Big War Loan Bill Ready for Debate,” *New York Times*, April 12, 1917, p. 2, “Economists United in Favor of War Tax,” *New York Times*, April 19, 1917, p. 24, “College Men Want Direct Taxes Instead of Bonds,” *Boston Daily Globe*, April 19, 1917, p. 7, and “Taxation is Favored to Meet War Expenses,” *Atlanta Constitution*, April 19, 1917, p. 6.

¹³ See, for example, Blakey (1918, p. 92).

CHART 2
Treasury Receipts and Expenditures,
Fiscal Year 1910 – Fiscal Year 1919



Source: Treasury annual reports.

The question of debt versus tax financing was resolved during the course of the war in a series of incremental actions, including especially new tax legislation.¹⁷ Chart 2 shows Treasury receipts and expenditures prior to and during the war. Assuming (based on the pre-war data) “normal” receipts and expenditures of about \$750 million per year, approximately one quarter of the cost of the war was financed with war taxes.¹⁸

¹⁴ See, for example, Anderson (1917, p. 860) (“Our own citizens must *pay now* out of current income whatever the government spends now, and, taking the nation as a whole, it is *simply impossible* for ‘posterity to share the burdens’....”) and Durand (1917, p. 892) (“For the people considered as a whole, domestic borrowing postpones no burden to the future.... Borrowing at home, so far as a nation as a whole is concerned, is precisely similar to borrowing by an individual from himself.... The idea that the burden of war expenditures can be deferred to future generations is the supreme fallacy of finance.”) Emphasis in the original.

¹⁵ Blakey (1918, p. 93). See also Blakey (1917, p. 813) (“Among persons of equal means, some are in a much better position to economize at this time than are others; hence, some borrowing is socially justifiable because it allows accommodation as between individuals.”) and Durand (1917, pp. 906-7).

¹⁶ Blakey (1918, p. 94).

¹⁷ The major wartime tax acts were the War Revenue Act of 1917, October 3, 1917, 40 Stat. 300, and the Revenue Act of 1918. See Blakey (1917) and Blakey and Blakey (1919).

¹⁸ Annual fiscal year receipts and expenditures in excess of “normal,” in billions of dollars, were:

	Receipts	Expenditures
1917	\$0.374	\$ 1.336
1918	3.430	13.043
1919	<u>3.904</u>	<u>18.202</u>
Total	\$7.708	\$32.581

The total excess of war-related tax receipts of \$7.7 billion was 23.7 percent of the \$32.6 billion in excess expenditures.

TABLE 1
Liberty Loans

	First	Second	Third	Fourth	Victory Liberty Loan
Description	Thirty-year bond, callable in fifteen years	Twenty-five-year bond, callable in ten years	Ten-year bond, not callable	Twenty-year bond, callable in fifteen years	Four-year note, callable in three years
Coupon rate (percent)	3½	4	4¼	4¼	3¾ if nontaxable, 4¼ if taxable
Dated date	June 15, 1917	November 15, 1917	May 9, 1918	October 24, 1918	May 20, 1919
First call date	June 15, 1932	November 15, 1927	Not callable	October 15, 1933	June 15, 1922
Maturity date	June 15, 1947	November 15, 1942	September 15, 1928	October 15, 1938	May 20, 1923
Amount offered (billions of dollars)	2.0	3.0	3.0	6.0	4.5
Amount subscribed (billions of dollars)	3.0	4.6	4.2	7.0	5.2
Amount sold (billions of dollars)	2.0	3.8	4.2	7.0	4.5
Subscription period	May 14–June 15, 1917	October 1–27, 1917	April 6–May 4, 1918	September 28– October 19, 1918	April 21– May 10, 1919

Source: Treasury annual reports.

The Treasury raised \$21.5 billion during the war by floating five enormous Liberty loans (Table 1); it also raised additional sums with monthly—sometimes biweekly—sales of short-term certificates of indebtedness. (Certificates of indebtedness were coupon-bearing securities that matured in a year or less. There was \$3.45 billion in certificates outstanding in mid-1919.)

All wartime security sales were by subscription. Treasury officials set the coupon rate on a new issue and then offered it to investors at a price of par. Subscription books for the Liberty loans remained open for three or four weeks; subscription books for certificates of indebtedness remained open for as little as one day, more typically for several weeks, and in one exceptional case for almost three months, depending on the pace of sales and how much the Treasury wanted to sell.¹⁹ The Treasury sometimes sold a fixed amount of Liberty loans that it specified *ex ante* (as in the sales of the First Liberty bonds and the Victory Liberty notes—see Table 1) and sometimes filled all subscriptions in full (as in the sales of the Third and Fourth

Liberty bonds). In cases where investors subscribed for an amount more than Treasury officials wanted to sell, officials allotted securities on the basis of order size, with a preference given to small orders to effect a broader distribution to retail investors. Table 2 presents an example.

To facilitate subscriptions to Liberty loans and certificates of indebtedness, the Treasury and the twelve district Federal Reserve Banks (acting as fiscal agents for the United States) created and managed a system of “War Loan Deposit Accounts” at commercial banks around the country.²⁰ A bank typically paid for its own and its customers’ purchases of Treasury securities by crediting the War Loan Deposit Account that the Treasury maintained at the bank. When funds were needed to meet expenses, the Treasury would request that some of the balances be transferred to Treasury accounts at Federal Reserve Banks (from which the Treasury paid most of the bills of the federal government). The system of War Loan accounts was important because it encouraged subscriptions: banks could pay for their purchases and the purchases of their customers with deposit credits in lieu of “immediately available” funds, that is, funds on deposit at a Federal Reserve Bank.²¹ War Loan deposit liabilities were relatively inexpensive

¹⁹ Subscription books for the first series of certificates offered to the public opened—and closed—on the same day that President Wilson signed the First Liberty Bond Act, April 24, 1917, 40 Stat. 35, that authorized their issue. “Secretary McAdoo to Sell Certificates,” *Wall Street Journal*, April 21, 1917, p. 5, “Loan Will Be Made at Once,” *New York Times*, April 25, 1917, p. 1, and “U.S. Certificates to be Paid for Today,” *Wall Street Journal*, April 25, 1917, p. 8. A later certificate series, designated series T-G, remained open from mid-August to early November 1918. “Tax Certificates at 4½% Meet Investment Conditions,” *Wall Street Journal*, November 7, 1918, p. 10, and 1918 Treasury Annual Report, pp. 215–6. See also “U.S. Tax Certificates Have Five Coupons Attached,” *Wall Street Journal*, October 12, 1918, p. 10.

²⁰ Section 7 of the First Liberty Bond Act provided that “the Secretary of the Treasury, in his discretion, is hereby authorized to deposit in such banks and trust companies as he may designate the proceeds . . . arising from the sale of the bonds and certificates of indebtedness authorized by this Act . . .” The system of War Loan accounts was the forerunner of the modern Treasury Tax and Loan system. See Garbade, Partlan, and Santoro (2004), Lovett (1978), McDonough (1976), and Brockschmidt (1975).

TABLE 2

Subscription Allotments on First Liberty Loan

Subscription	Allotment
Up to and including \$10,000	100 percent
\$10,000 to \$100,000	60 percent, but not less than \$10,000
\$100,000 to \$250,000	45 percent, but not less than \$60,000
\$250,000 to \$2,000,000	30 percent, but not less than \$112,500
\$2,000,000 to \$6,000,000	25 percent, but not less than \$600,000
\$6,000,000 to \$10,000,000	21 percent
Over \$10,000,000	Average of 20.2 percent

Source: 1917 Treasury Annual Report, p. 8.

and cost banks only 2 percent per annum.²² (By comparison, borrowing from a Federal Reserve Bank cost between 3 and 4½ percent per annum in 1917 and 1918.)²³

2.2 The Mechanics of Paying Down the Debt

The principal problem facing Treasury debt managers in the 1920s was how to pay down the large Liberty loans with budget surpluses that became available only gradually over time. They solved the problem with a carefully constructed program of 1) exchange offers of new notes and bonds for Liberty loans approaching maturity, 2) cash refinancings (with short-term certificates and intermediate-term notes) of maturing Liberty loans, and 3) cash repurchases of debt near maturity and cash redemptions at maturity. Tilford Gaines, in his groundbreaking study of Treasury debt management, concluded that “the decade of the 1920’s witnessed what is probably the most effective execution of debt management policy, in a technical sense, in the history of the country.”²⁴ Gaines pointed out that

Policy actions of the 1920’s were directed toward specific, clearly-stated objectives. Maturing securities were redeemed if funds were available . . . if not, they

²¹ Additionally, the War Loan Deposit Account System avoided draining reserves from the private banking system into Treasury accounts at Federal Reserve Banks when investors paid for their securities.

²² The 2 percent rate was established prior to the war for an earlier depository system that was limited to national banks. See “Banks Must Pay 2 Per Cent,” *New York Times*, April 24, 1912, p. 15, “Government Special Deposits,” *Wall Street Journal*, April 25, 1912, p. 8, “Money,” *Wall Street Journal*, April 26, 1912, p. 8, “Must Pay Interest on Nation’s Cash,” *New York Times*, May 1, 1913, p. 1, “Banks Must Pay Interest on All Government Deposits,” *Wall Street Journal*, May 2, 1913, p. 8, 1912 Treasury Annual Report, p. 149, and 1913 Treasury Annual Report, pp. 5 and 211.

²³ Board of Governors of the Federal Reserve System (1943, p. 439).

²⁴ Gaines (1962, p. 27).

TABLE 3

Treasury Debt in Mid-1923
Billions of Dollars

Pre-war debt	0.87
Liberty Loans	
First Liberty Bond	1.95
Second Liberty Bond	3.20
Third Liberty Bond	3.41
Fourth Liberty Bond	6.33
Total	14.89
Post-war debt	
Certificates of indebtedness	1.03
Notes	4.10
Bonds	0.76
Total	5.89
Other debt	0.35
Total debt	22.01

Source: 1923 Treasury Annual Report, pp. 134-5.

were refunded to a carefully selected niche in the debt structure where, when they matured, funds might be expected to be available to redeem them.²⁵

and that

At a purely technical level, the job done by Secretary Mellon during the 1920’s was superb. Each operation, whether intra-year certificate financing or refunding the Liberty and Victory loans, was carefully planned and conducted through a series of steps that at no time overstrained the market’s absorptive capacity. The program was orderly, with ample advance notice to the market before each step, and predictable, in the sense that the Secretary’s program and intentions were clearly understood.²⁶

Treasury indebtedness stood at \$22 billion in mid-1923 (Table 3). During the preceding four years, the Treasury had paid off the Victory notes, reduced the outstanding amount of the four remaining Liberty bonds to \$15 billion, and reduced the short-term debt to \$1 billion. In the process, it had issued \$4 billion of new notes maturing between June 1924 and December 1927 (Table 4) as well as a modest amount (\$760 million) of new bonds. The new notes had been issued for two reasons: to refinance \$2.6 billion of short-term certificates of indebtedness to dates after the Victory notes matured in May 1923 but before the Third Liberty bonds came

²⁵ Gaines (1962, p. 29).

²⁶ Gaines (1962, p. 34).

TABLE 4

Treasury Notes Issued between 1921 and 1923 to Refinance Shorter Term Debt and Maturing Victory Notes

Issue Date	Coupon (Percent)	Maturity	Amount (Millions of Dollars)
June 15, 1921	5¾	June 15, 1924	311
September 15, 1921	5½	September 15, 1924	391
February 1, 1922	4¾	March 15, 1925	602
December 15, 1922	4½	June 15, 1925	469
June 15, 1922	4¾	December 15, 1925	335
March 15, 1922	4¾	March 15, 1926	618
August 1, 1922	4¼	September 15, 1926	487
May 15, 1923	4¾	March 15, 1927	668
January 15, 1923	4½	December 15, 1927	367
Total			4,248

Source: Treasury annual reports.

due in September 1928, and to refinance a portion of the maturing Victory notes.

All the new notes matured on the fifteenth of the third month of a calendar quarter—when most individuals and corporations made quarterly income tax payments.²⁷ This was no accident; rather, it was part of a larger scheme designed to facilitate redemption of the notes and, more generally, redemption of the war debt. As a tax payment date approached, Treasury officials estimated the receipts they were about to receive and the funds they were likely to disburse during the coming quarter. They used balances in Treasury accounts at Federal Reserve Banks and in War Loan Deposit Accounts at commercial banks equal to the estimated excess of receipts over expenditures to redeem some of the maturing debt, and they refinanced the remainder to a subsequent tax date.²⁸ The 1922 Treasury Annual Report noted that the practice of having issues

²⁷ The Revenue Act of 1918 provided that the tax on income earned in a particular year was due in four quarterly installments during the following year, on March 15, June 15, September 15, and December 15.

²⁸ See, for example, 1926 Treasury Annual Report, p. 35 (“A few weeks prior to the 15th of each September, December, March, and June the Treasury determines what income it will need to meet expenditures during the coming quarter, taking into account, on the receipt side, the cash in the general fund and the Government receipts to be expected, and, on the expenditure side, the amount of cash required to meet obligations maturing during the quarter, and the probable expenses of the Government during the quarter.”) and p. 39 (“New issues of public debt securities in regular course are made only on tax-payment dates and the amount of the issue is determined by the estimated cash requirements of the Treasury to the next payment date in excess of the cash in hand and the estimated receipts from taxes and other sources of revenue.”).

mature on quarterly tax dates absorbed “any surplus revenues which may be available. This gives the best assurance of the gradual retirement of the war debt, and is perhaps the greatest advantage of the short-term [that is, note] refunding which the Treasury has been carrying on, for by distributing the debt over early maturities in amounts not too large to be financed each year these refunding operations have given the Treasury control over the debt and its retirement. . . .”²⁹

Table 5 illustrates how the scheme worked. The first column shows the four tax payment dates in 1925. The second column shows the amount of securities maturing on

The “regularization” of Treasury financing operations on quarterly tax dates was an important innovation in Treasury debt management.

each of the four dates. The third shows the amount of securities issued on each date, including a 29¾-year bond in March and certificates of indebtedness in every quarter. The fourth shows the amount paid down.

The “regularization” of Treasury financing operations on quarterly tax dates was an important innovation in Treasury debt management.³⁰ The regularity enhanced the predictability of Treasury operations and facilitated the integration of Treasury debt management with Treasury cash management. Nevertheless, the system was not flawless. The maturities of new certificates varied erratically from quarter to quarter (Chart 3), and the sizes of new offerings also varied widely, depending on the amount maturing and the magnitude of anticipated tax receipts and expected expenditures (Chart 4). These features reduced the predictability of two important aspects of a financing: amount and term to maturity.³¹ On balance, however, the

²⁹ 1922 Treasury Annual Report, p. 9. See also 1923 Treasury Annual Report, p. 20 (“Except for the issue of about \$750,000,000 of 25-30 year Treasury bonds in the fall of 1922, the refunding has all been on a short-term basis, and it has been arranged with a view to distributing the early maturities of debt at convenient intervals over the period before the maturity of the third Liberty loan in 1928 in such manner that surplus revenues may be applied most effectively to the gradual reduction of the debt. With this object in view all of the short-term notes issued in the course of the refunding have been given maturities on quarterly tax-payment dates, and all outstanding issues of Treasury certificates have likewise been reduced to tax maturities.”)

³⁰ There were only two cases after 1922 when certificates of indebtedness were sold on other than a tax payment date: an issue of 213-day certificates sold in November 1927 to finance the redemption of Second Liberty bonds and an issue of 335-day certificates sold in October 1928 to finance the redemption of Third Liberty bonds.

TABLE 5

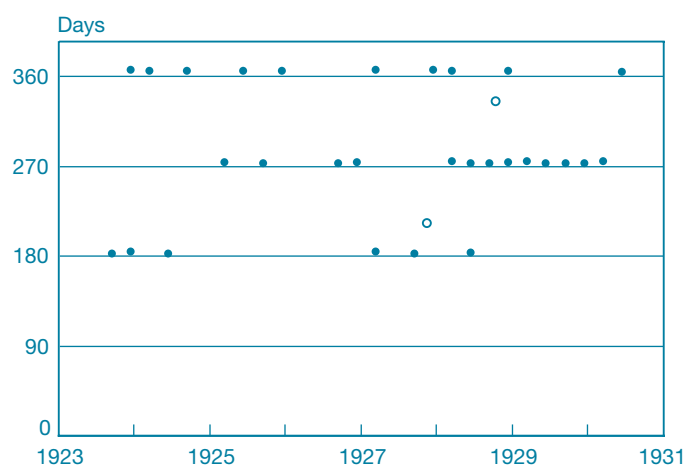
Refinancings and Paydowns on Tax Payment Dates in 1925

Date	Amount (Millions of Dollars)			Refinancing Securities
	Maturing	Issued	Paid Down	
March 15, 1925	560	509	51	\$219 million of a nine-month certificate maturing December 15, 1925, and \$290 million of a 29¾-year bond maturing December 15, 1954
June 15, 1925	400	124	276	One-year certificate maturing June 15, 1926
September 15, 1925	250	252	-2	Nine-month certificate maturing June 15, 1926
December 15, 1925	480	453	27	One-year certificate maturing December 15, 1925

Sources: 1925 Treasury Annual Report, pp. 32 and 33; 1926 Treasury Annual Report, p. 41; “Treasury to Issue 4% Bonds at Premium,” *Wall Street Journal*, March 5, 1925, p. 8; “June Funding Issue Lowest Since War,” *New York Times*, June 8, 1925, p. 24; “New Treasury Issue Is \$250,000,000,” *New York Times*, September 8, 1925, p. 32; and “Treasury Will Seek a \$450,000,000 Loan,” *New York Times*, December 7, 1925, p. 37.

CHART 3

Term to Maturity at Original Issuance of Certificates of Indebtedness

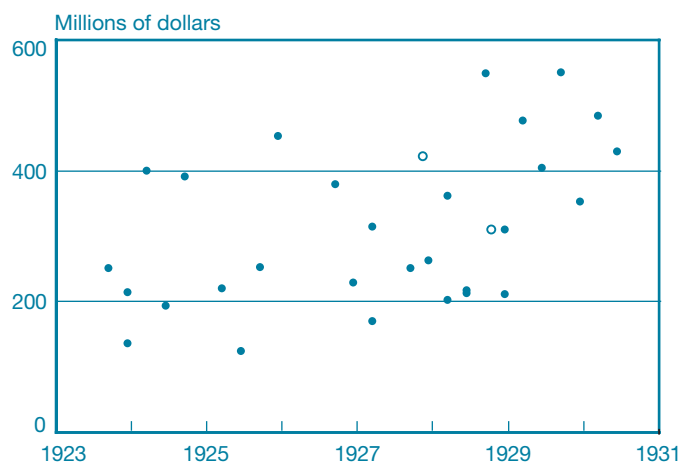


Source: Treasury annual reports.

Note: Dark circles are certificates issued on tax payment dates; white circles are certificates issued on a date other than a tax payment date.

CHART 4

Issue Size of Certificates of Indebtedness



Source: Treasury annual reports.

Note: Dark circles are certificates issued on tax payment dates; white circles are certificates issued on a date other than a tax payment date.

program of regular quarterly financings was an innovative solution to the problem of paying down large debt issues with budget surpluses that became available only gradually, on a quarterly basis.

³¹ In contrast, the Treasury regularized term to maturity and offering amounts as well as offering dates when it adopted a “regular and predictable” issuance strategy for notes and bonds in the 1970s (Garbade 2007).

3. STRUCTURAL FLAWS IN TREASURY FINANCING OPERATIONS

There were several important structural flaws in Treasury financing operations in the mid- and late 1920s. The flaws, all of which were well understood by early 1929, were attributable to the continuation of the wartime practices of selling securities in fixed-price subscription offerings and allowing banks to pay for purchases of securities with War Loan Deposit Account

credits, in addition to the newer practice of limiting Treasury debt sales to quarterly dates.

3.1 Fixed-Price Subscription Offerings

Fixed-price subscription offerings gave Treasury officials an incentive to offer securities at cheap prices, relative to contemporaneous market conditions, to limit the risk of a failed offering.

The risk of a failed offering was more than conjectural. In March 1920, Treasury officials proposed to raise between \$300 and \$350 million in an offering of one-year certificates.³² Investors resisted what they believed to be an unreasonably low interest rate of 4¾ percent. In a meeting with Assistant Secretary of the Treasury Russell Leffingwell, New York bankers expressed intense dissatisfaction with the rate and suggested that the new certificates should pay “at least” 5 percent.³³ Investors subscribed for only \$200 million of the certificates, even though officials kept the subscription books open for two weeks after the issue date.³⁴ The *New York Times* described the response as “disappointingly small” and the *Wall Street Journal* labeled the 4¾ percent rate “a mistake.”³⁵ Two-and-a-half years later, in December 1922, the Treasury offered a total of \$400 million in three-month and one-year certificates, but garnered only \$310 million in subscriptions, including \$45 million in last-minute subscriptions from three Federal Reserve Banks.³⁶ These episodes gave Treasury officials clear incentives to avoid pricing their offerings close to the market, that is, selecting coupon rates close to contemporaneous market yields on outstanding issues with similar maturities.

Oversubscriptions—the principal indicia of underpricing—were a persistent characteristic of Treasury offerings throughout the 1920s (Chart 5). The *Wall Street Journal* pointed out the problem as early as April 1921: “The fact that there has been a big over-subscription to recent offerings of certificates of indebtedness, suggests that the rate fixed for the certificates has lately been slightly higher than the money market warranted.”³⁷ A month later, the *Wall Street Journal*

³² “The Certificate Sale,” *New York Times*, March 23, 1920, p. 18.

³³ “Treasury Offers New 4¾% Tax Certificates,” *Wall Street Journal*, March 10, 1920, p. 12 (characterizing the bankers as “vexed”).

³⁴ 1920 Treasury Annual Report, p. 15.

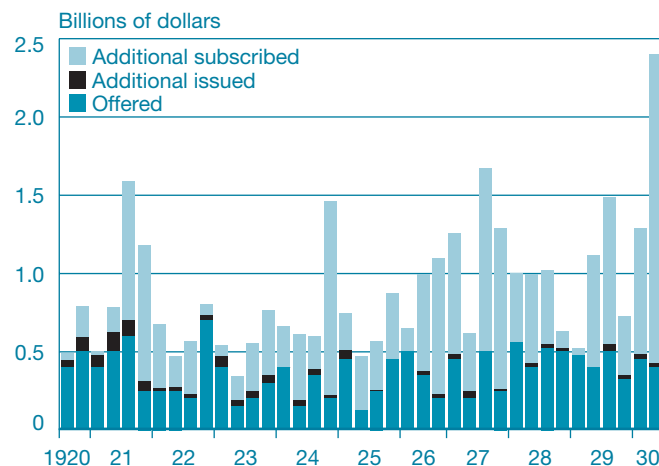
³⁵ “The Certificate Sale,” *New York Times*, March 23, 1920, p. 18, and “Treasury Made Mistake in Certificate Rate at 4¾%,” *Wall Street Journal*, March 30, 1920, p. 12.

³⁶ 1923 Treasury Annual Report, pp. 51-2, and letter dated December 16, 1922, from Under Secretary of the Treasury S. Parker Gilbert to Charles Morss, Governor, Federal Reserve Bank of Boston, Federal Reserve Bank of New York Archive File no. 410.5.

³⁷ “Government Borrowing by Tender Suggested Here,” *Wall Street Journal*, April 14, 1921, p. 4.

CHART 5

Amounts Offered, Issued, and Subscribed in Quarterly (Tax Payment Date) Offerings of Treasury Securities



Source: Treasury annual reports.

remarked on the advantage of auctioning securities: “Bankers point out that [the \$275 million oversubscription on an offering of \$200 million of nine-month certificates] is another illustration of the advantage that might have been afforded by adopting the system of offering the certificates at tender. Had they been offered by tender a considerable saving might have been effected.”³⁸

3.2 Infrequent Offerings

The decision to limit security sales to a quarterly schedule compelled the Treasury to borrow in advance of actual requirements and inventory the proceeds in War Loan accounts until they were needed. In testimony before the House Ways and Means Committee in May 1929, Under Secretary of the Treasury Ogden Mills observed that “it is reasonably clear that if you are going to borrow only four times a year, you have got to borrow in advance of requirements.”³⁹ This method was expensive because the 2 percent interest rate that the Treasury earned on War Loan accounts was less than what it paid on its certificates of indebtedness.

³⁸ “Government Borrowing,” *Wall Street Journal*, May 19, 1921, p. 4.

³⁹ Committee on Ways and Means (1929, p. 3).

3.3 Late Tax Payments

Late tax payments sometimes led to undesirable volatility in overnight loan markets. The 1925 Treasury Annual Report observed that, “Frequently payments [on maturing issues] exceed [tax] receipts on the tax day, making it necessary to borrow temporarily from the Federal reserve bank on a special securities of indebtedness [sic] in anticipation of the tax receipts which it takes several days to collect. This places reserve bank funds temporarily on the market and results in easier money rates. Rates tighten up again, however, when the loan is repaid, upon the collection of the tax checks.”⁴⁰

3.4 Substitution of Treasury Deposits for Other Sources of Funds

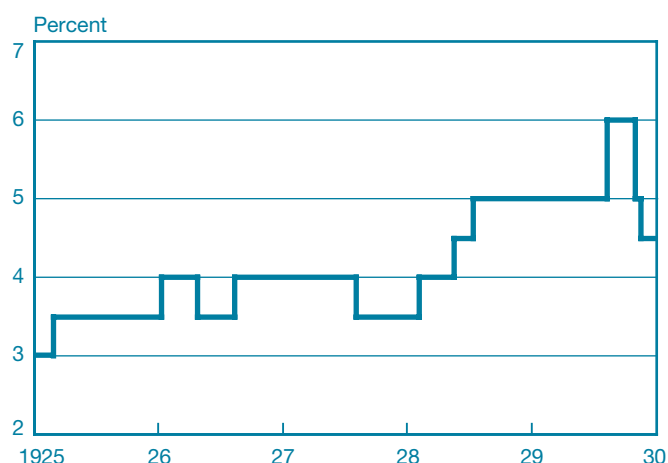
Banks learned in the 1920s that they could use Treasury securities subscriptions to substitute Treasury deposits for other, more expensive, sources of funds. A bank would first subscribe to a new offering, promising to pay by crediting the Treasury’s War Loan Deposit Account at the bank. After receiving notice of its allotment, the bank would sell the new securities for settlement on the issue date and, following settlement, use the proceeds to reduce other borrowings. The net result was a reduction in the cost of funds to 2 percent per annum during the period between the issue date of the securities and the date the Treasury called for its War Loan balances.

Substituting War Loan deposits for other sources of funds became increasingly attractive when the Reserve Banks began to raise discount rates in 1928 (Chart 6). Substitution made economic sense even if a bank had to sell its allotment at a discount from the par subscription price, as long as interest rates were high enough and the period in which the bank could expect to retain War Loan balances was long enough. In June 1928, the *New York Times* reported bank sales of new certificates at prices of 99-31/32 and 99-30, even though the certificates had been heavily oversubscribed:

⁴⁰ 1925 Treasury Annual Report, p. 44. See, for example, the episode described in the Federal Reserve Bank of New York’s *Monthly Review*, April 1, 1930, pp. 1-2, in which a temporary \$200 million increase in member bank reserves led to a transient decline in call loan rates. Treasury borrowings from the Federal Reserve typically lasted for about five days. Committee on Ways and Means (1929, p. 9). To dampen these episodes of transient ease, the Reserve Banks sometimes sold participations in their Treasury loans to member banks. At other times, member banks used the surplus reserve balances to reduce temporarily their Reserve Bank borrowings. “New Factor Enters Treasury Financing,” *New York Times*, December 15, 1929, p. N11. Meltzer (2003, p. 203, n. 106) reports that, in July 1924, the Open Market Investment Committee (a forerunner of the Federal Open Market Committee) approved a proposal to sell and repurchase securities to reduce transient dips in money market rates during tax payment periods. Beckhart, Smith, and Brown (1932, p. 357) describe other methods of draining excess reserves.

CHART 6

Federal Reserve Bank of New York Discount Rate



Source: Board of Governors of the Federal Reserve System (1943, pp. 440-1).

This paradox of an issue being apparently heavily oversubscribed [at a primary market offering price of par] at the same time that [secondary market] sales are being made below par was explained by conditions in the money market and the opportunity for profit arising out of the methods by which the Government securities are sold to the banks, their largest purchasers. When Government securities are awarded on subscription the banks do not pay for them at once, but credit the Treasury’s account with the sum involved. This money is left on deposit until the Treasury calls for it, a period which is usually two or three weeks and sometimes stretches into months. The banks pay the Treasury 2 per cent interest on these deposits.⁴¹

The following April, the *New York Times* reported that wide spreads between open market interest rates and the War Loan Deposit Account rate gave banks an incentive “to bid for larger amounts of Treasury securities than they ordinarily would take, and they often sell the securities as soon as they are allotted. At times, this produces the spectacle of a Treasury issue being heavily over-subscribed and simultaneously selling below par . . . a situation that makes for confusion and artificial values in Treasury financing.”⁴²

In response to bank oversubscriptions for, and prompt sales of, new Treasury offerings, nonbank investors began to abstain from subscribing for new issues, electing instead to acquire the securities in post-offering secondary market transactions.

⁴¹ “Sales Reported in Treasury Issue,” *New York Times*, June 9, 1928, p. 25.

⁴² “New Treasury Plan Similar to English,” *New York Times*, April 28, 1929, p. 39.

Under Secretary Mills summed up the problem in his 1929 testimony before the Ways and Means Committee:

“There has grown up recently a practice on the part of the banks which was somewhat detrimental to the credit of the Government. Banks unquestionably subscribe for Government certificates because of the deposit privilege. During the last year or so, which has been a period of tight money, a practice has developed on the part of the banks of selling these certificates sometimes even before they are issued. In other words a bank can afford to subscribe for these certificates and sell them at a loss of say two-thirty-seconds or four-thirty-seconds and even six-thirty-seconds and still show a profit on the transaction, providing it can keep the Government deposit for 30 or 40 days. What the bank is really doing is borrowing from the Government of the United States at 2 per cent for 30 or 40 days, and it can use that money at once to pay off its indebtedness to the Federal reserve bank, in which it is paying 5 per cent. It can of course afford under these circumstances to sell these certificates at a discount. So that Government certificates during the course of the last year have sold at less than par almost immediately when they were issued. And, of course, those corporations and individuals who want to invest in Government securities, having observed that they show a tendency to go below par almost immediately after issue, refrain from putting in their subscriptions at the time the certificates are offered and rely on their ability to buy them in the market afterwards.”⁴³

Allowing banks to pay for securities with War Loan Deposit Account credits did not benefit either the Treasury or the banks. The Treasury gained by being able to issue securities to banks at a higher price than the general public was willing to pay, but earned only 2 percent on the proceeds left on deposit with the banks. Banks gained from accessing cheap Treasury balances, but lost when they sold certificates to nonbank investors at prices below par. Nonbank investors neither gained nor lost (as long as they waited to buy securities in the secondary market). The principal consequence of the scheme was a primary market increasingly limited to banks and opaque to the general public.

3.5 Summary

By the beginning of 1929, Treasury officials understood the flaws in the existing structure of Treasury financing operations:

- 1) Fixed-price subscription offerings resulted in chronic oversubscriptions, a clear indication that offerings were persistently underpriced.

⁴³ Committee on Ways and Means (1929, pp. 4-5).

- 2) Infrequent quarterly financings forced the Treasury to borrow in advance of its needs and to inventory the proceeds in low-yielding War Loan Deposit Accounts.
- 3) Late tax payments forced the Treasury to fund the redemption of debt maturing on tax payment dates with Federal Reserve Bank loans.
- 4) The ability of banks to pay for new issues by crediting War Loan accounts led to the substitution of War Loan deposits for other sources of funds, led banks to further oversubscribe for new issues (in order to generate larger War Loan balances), and contributed to the appearance of a weak secondary market in new issues. The anomaly of oversubscribed issues selling below the par subscription price suggests that Treasury officials priced securities too high for nonbank investors in 1928 and 1929, even if they were cheap for bank subscribers.

The next section describes how Treasury officials mitigated the flaws in their financing operations.

4. INTRODUCTION OF TREASURY BILLS

In early 1929, J. Herbert Case, the Deputy Governor of the Federal Reserve Bank of New York, journeyed to London to study the British Treasury bill market. The study, undertaken at the behest of Under Secretary of the Treasury Ogden Mills, was intended to clarify whether the British system of issuing bills could be adapted for use in the United States.⁴⁴ Upon his return, Case filed a report describing the British system (Box 2) and recommended that a variant of the system be introduced in the United States.⁴⁵

Case’s plan had four major provisions:

- 1) Treasury bills would be auctioned rather than offered for sale at a fixed price. He pointed out that “Competitive

⁴⁴ Case’s trip was not his first involvement in this matter. In January 1928, Case provided a detailed analysis of the British bill market to Benjamin Strong, Governor of the Federal Reserve Bank of New York, in which he explored several ways the British system could be adapted to American markets. Memo dated January 4, 1928, from Case to Strong, “Discussion of method of handling short term debt by United States Treasury, including comparison with British Treasury method,” Federal Reserve Bank of New York Archive File no. 413.7. In his 1928 memo, Case focused on the use of regular, possibly weekly, bill offerings to reduce Treasury borrowings before funds were needed, but also noted the advantages inherent in auctioning bills. He further noted that reliance on bill financing could result in the demise of the War Loan Deposit Account system, and he questioned whether such a demise would be a desirable result: “The depository bank system was built up during the war and was unquestionably of great value to the Treasury in floating the war debt and in its subsequent refunding.”

⁴⁵ The report is attached to a letter dated February 16, 1929, from Case to Under Secretary Mills, Federal Reserve Bank of New York Archive File no. 413.7. Case also visited the Banque de France but did not make any detailed study of French debt management techniques.

The Primary Market for British Treasury Bills^a

At the beginning of 1929, there was about £600 million in British Treasury bills outstanding. The British Treasury had been issuing bills since about 1877. Pre-war emissions were relatively small and infrequent, but issuance increased substantially during and following World War I.

British bills were auctioned weekly—on Friday, for settlement the following week—and matured three months later. Bidders submitted tenders that specified a price and amount as well as a settlement day sometime during the following week. Treasury officials sorted the tenders by settlement day and accepted proposals for a given settlement day in order of decreasing price until they had accounted for all of the funds needed to be raised on that day. Successful bidders paid for their bills with drafts on the Bank of England, that is, with immediately available funds.

The British system of bill financing—particularly the daily emissions and maturities—fitted nicely with the British income tax system. Although there were dates when taxes were nominally due, revenue officials had considerable discretion to arrange for alternative payment dates, so that payments did not all come in at virtually the same time. This ability eliminated any possibility of large, sporadic drains of reserve balances from the banking system and, taken together with the process of bill financing, made a system like the American War Loan Deposit Accounts unnecessary.^b

^aBased on memo dated January 4, 1928, from J. Herbert Case, Deputy Governor, Federal Reserve Bank of New York, to Benjamin Strong, Governor, Federal Reserve Bank of New York, “Discussion of method of handling short term debt by United States Treasury, including comparison with British Treasury method,” Federal Reserve Bank of New York Archive File no. 413.7, and report attached to letter dated February 16, 1929, from Case to Ogden Mills, Under Secretary of the Treasury, Federal Reserve Bank of New York Archive File no. 413.7. See also “New Treasury Plan Similar to English,” *New York Times*, April 28, 1929, p. 39.

^bSee also address of Under Secretary Mills before the Washington Chapter of the American Institute of Banking on April 24, 1929, reprinted in 1929 Treasury Annual Report, p. 279 (“The Treasury bill has been used for many years by the British Treasury as a most convenient and economical medium to obtain funds to meet current needs. They have so developed the system of financing by means of Treasury bills that, with weekly offerings, daily issues, and daily maturities, they have obtained a degree of flexibility that enables the Treasury to adjust its cash positions practically from day to day.”) and “Mills Explains Aim of Treasury Bills,” *New York Times*, April 25, 1929, p. 42.

bidding . . . might be expected to enable the Treasury to get the lowest discount rates consistent with current market conditions; it would not be necessary for the Treasury . . . to offer interest rates on new issues above current market rates.”

- 2) Bills would be sold when funds were needed.
- 3) Bill maturities would be set “to correspond closely to the actual collection of income taxes, and not all made to fall on the nominal date of tax payments as at present.”
- 4) Sales would be for cash, instead of credits to War Loan Deposit Accounts.

Point by point, these provisions would cure all of the existing flaws in the structure of Treasury financing operations. Case’s plan set the framework for the introduction of a new instrument to American financial markets.⁴⁶

4.1 Obtaining Statutory Authority to Issue Bills

In late April 1929, the Treasury unveiled its proposal to correct the defects in its financing operations. Senator Reed Smoot, chairman of the Senate Finance Committee, and Representative Willis Hawley, chairman of the House Ways and Means Committee, took the first step by introducing legislation to allow the Treasury to issue zero-coupon bills with maturities of up to one year at a discount from face value.⁴⁷ (The Treasury needed new statutory authority to issue bills because existing statutes did not allow the sale of Treasury securities at a price less than par.)⁴⁸

The proposed legislation required that the Treasury offer the new securities “on a competitive basis.”⁴⁹ Officials viewed auction offerings as a key provision. Treasury Secretary Mellon stated that “Competitive bidding . . . should enable the Treasury to get the lowest discount rates consistent with current market conditions.”⁵⁰ In testimony before the Ways and Means Committee, Under Secretary Mills pointed out the burden of fixed-price offerings as well as the advantage of auctions:

⁴⁶ “Case Heads Board of Reserve Bank,” *New York Times*, February 28, 1930, p. 14 (commenting that Case’s 1929 report was the basis for the Treasury’s introduction of Treasury bills).

⁴⁷ “Treasury for Sale of Notes Below Par,” *New York Times*, April 23, 1929, p. 27.

⁴⁸ Section 5 of the Second Liberty Bond Act of September 24, 1917, 40 Stat. 288, authorized the Secretary of the Treasury to issue certificates of indebtedness “at not less than par.” Section 1 of the same act authorized the issue of bonds and required that they “first be offered at not less than par as a popular loan.” The Victory Liberty Loan Act of March 3, 1919, 40 Stat. 1309, authorized the issue of notes “at not less than par.”

⁴⁹ See H.R. 1648, reprinted in Committee on Ways and Means (1929, p. 1).

⁵⁰ “Treasury for Sale of Notes Below Par,” *New York Times*, April 23, 1929, p. 27.

[T]he Treasury has the difficult task of estimating accurately current market conditions so as to adjust the interest rate as closely as possible to those conditions, using the best judgment that it can. It is not as difficult as it seems and yet, with money conditions fluctuating very rapidly from day to day, it is not an easy thing It would be more desirable both from the standpoint of the Treasury and I think of the public, if the market itself, by competitive bidding, should fix the interest rate, rather than have the Secretary of the Treasury use his best judgment in fixing the rate.⁵¹

Mills expressed the view that “the market will adjust the interest rate much more closely to actual market conditions than we can. We rather expect that these bids will be made in terms of one twenty-fifth of 1 per cent.”⁵² (At the time, the Treasury was setting coupon rates on certificates of indebtedness in increments of 1/8 percent.)

The Congress quickly approved the proposed legislation, and President Hoover signed it into law on June 17, 1929.⁵³ During the following six months, Treasury officials worked out the details of the new security, such as the wording that would appear on the face of a bill and how it would be sold to the public.

4.2 The First Auction

On Tuesday, December 10, 1929, the Treasury announced the first bill auction, offering \$100 million of ninety-day bills for settlement on Tuesday, December 17, to mature Monday, March 17, 1930.⁵⁴ Auction tenders were due by 2 p.m. on Friday, December 13. Each tender had to state the amount bid for and a bid price, specified as a percentage of face amount with three digits of precision to the right of the decimal point⁵⁵

⁵¹ Committee on Ways and Means (1929, p. 3).

⁵² Committee on Ways and Means (1929, p. 4).

⁵³ The Act of June 17, 1929, 46 Stat. 19, provided that the original issue discount on a bill was interest income and would be exempt from state and federal income taxes. However, any gains or losses upon sale prior to maturity, computed net of the accrued interest to the settlement date of the sale, was subject to capital gains tax. See Treasury Decision 4276, November 22, 1929, reprinted in 1930 Treasury Annual Report, pp. 306-8. The latter provision proved unworkable and was eliminated by the Act of June 17, 1930, 46 Stat. 775. See amended Treasury Circular no. 418, June 25, 1930, reprinted in 1930 Treasury Annual Report, pp. 309-12, letter dated June 30, 1930, from Andrew Mellon, Secretary of the Treasury, reprinted in 1930 Treasury Annual Report, p. 309, 1930 Treasury Annual Report, p. 23 (“The bookkeeping records required in order to calculate gains, as differentiated from exempt interest, were so complicated that a very real sales resistance resulted.”), and Beckhart, Smith, and Brown (1932, p. 354, fn. 34) (The corrective measure “was rendered necessary by the large amount of burdensome bookkeeping necessary to comply with the terms of the Act of June, 1929.”).

⁵⁴ Federal Reserve Bank of New York Circular no. 949, December 10, 1929. See also Treasury Circular no. 418, November 22, 1923, reprinted in 1930 Treasury Annual Report, pp. 303-6, and Federal Reserve Bank of New York Circular no. 944, November 23, 1929.

(for example, 99.172 percent). Tenders would be accepted in order of decreasing bid price (auction market participants could submit multiple tenders with different bids) and tenders at the lowest accepted price (the “stop-out” price) would be allotted securities on a pro-rata basis. Payment would be due on the settlement date in immediately available funds and could not be made by crediting a War Loan account.

On Saturday, December 14, the Treasury announced that investors had bid for \$224 million of the new bills and that it had accepted tenders starting at the highest bid, 99.310 percent, and stopping at 99.152 percent.⁵⁶ Tenders bidding at the stop were allotted 80 percent of the amount bid for.⁵⁷ The average accepted price was 99.181. A syndicate of two dealers, Salomon Brothers & Hutzler and the International Manhattan Company, won the major portion of the offering and promptly reoffered \$70 million of the bills at a discount rate of 3 1/8 percent, or a price of 99.219.⁵⁸

Under Secretary Mills stated that he was “entirely satisfied” with the results of the auction and that the auction had resulted in “considerably cheaper money than we could get through the medium of certificates of indebtedness”⁵⁹ He further noted that the government would henceforth be able to tailor its borrowings more closely to its needs: “We will not be in a position where we have to borrow a lot of money and hold it in anticipation of needs for which we have only estimates We will sell government bills to fit the immediate needs and make the maturities fit into a known time of income, that is, the tax-paying dates.”⁶⁰

4.3 Subsequent Bill Offerings in 1930

The Treasury offered Treasury bills on seven occasions in 1930 (Table 6). The offerings were all in the middle of the first or

⁵⁵ Bidding on a price basis insulated the Treasury from specifying how bids in terms of interest rates would be converted to prices. Market participants used a variety of conventions. For example, the price of a bill with n days to maturity quoted at a discount rate of D is $P = 100 - (n/360) \times D$. The price of the same bill quoted at a money market yield of R is $P = 100 / [1 + .01 \times (n/360) \times R]$. In the case of a ninety-day bill quoted at 4.50 percent, $P = 98.875$ if the quoted rate is a discount rate, that is, if $D = 4.50$ percent, and $P = 98.888$ if the quoted rate is a money market yield, that is, if $R = 4.50$ percent.

⁵⁶ “Plan Further Use of Treasury Bills,” *New York Times*, December 15, 1929, p. 16.

⁵⁷ “Treasury Bills Well Received,” *Wall Street Journal*, December 17, 1929, p. 12.

⁵⁸ “3 1/8% Discount Rate on Treasury Bills,” *New York Times*, December 16, 1919, p. 47. The International Manhattan Company was the securities division formed following the March 1929 merger of the International Acceptance Bank, Inc., and the Bank of Manhattan. The reoffering price is computed as $99.219 = 100 - (90/360) \times 3.125$.

⁵⁹ “Plan Further Use of Treasury Bills,” *New York Times*, December 15, 1929, p. 16, and “Issue Satisfies Mills,” *Wall Street Journal*, December 16, 1929, p. 11.

⁶⁰ “Plan Further Use of Treasury Bills,” *New York Times*, December 15, 1929, p. 16.

TABLE 6

Treasury Bill Sales in 1930

Auction Date	Issue Date	Maturity Date	Term (Days)	Amount (Millions of Dollars)
February 14, 1930	February 18, 1930	May 19, 1930	90	50
April 11, 1930	April 15, 1930	July 14, 1930	90	50
May 15, 1930	May 19, 1930	August 18, 1930	91	100
July 10, 1930	July 14, 1930	September 15, 1930	63	50
August 14, 1930	August 18, 1930	November 17, 1930	91	120
October 10, 1930 ^a	October 15, 1930	December 16, 1930	62	50
October 10, 1930 ^a	October 16, 1930	December 17, 1930	62	50
November 13, 1930	November 17, 1930	February 16, 1931	91	125

Source: Treasury annual reports.

^aThe Treasury offered a total of \$100 million bills. Each accepted tender was allocated half of the amount bid for in bills issued on October 15 and maturing on December 16, 1930, and the other half in bills issued on October 16 and maturing on December 17, 1930.

second month of a quarter, suggesting that the Treasury did, in fact, modify its financing practices by selling bills when it needed cash.

It is interesting to note that four of the six offerings that matured in 1930 did not mature on a tax payment date (the exceptions are the July offering that matured in September and the twin offering in October that matured in December) and that all four of those offerings were refinanced at maturity with new bills. This suggests that Treasury officials began at an early date to incorporate Treasury bills into their debt management operations and that they did not limit the use of Treasury bills to sporadic cash management needs.

5. TREASURY BILLS IN THE EARLY 1930S

The Treasury began issuing bills just as the Great Depression was beginning. It is hardly surprising that officials did not use the new instrument quite as they had anticipated in 1929; evolving circumstances can prompt change in the use of any financial instrument.

As the contraction of 1930 deepened and hardened into depression in 1931, the Treasury began to issue thirteen-week bills almost every week (Chart 7). Although issue sizes varied from week to week (Chart 8), the aggregate volume of bills outstanding rose fairly steadily to more than \$500 million by the end of 1931 (Chart 9). The quantity of bills outstanding stabilized during 1932, but then rose sharply in 1933 and again in 1934, reaching almost \$2 billion at the end of 1934. By the end of 1934, Treasury bills had become an instrument of debt management—part of the more or less permanent debt of the nation.

Treasury officials did not originally intend to replace certificates of indebtedness with Treasury bills. Secretary Mellon stated in 1929 that “It is not the purpose of the Treasury Department . . . to discontinue the present depository method, or system of short-term financing, but rather to supplement it with the new system, using both as may prove to be most advantageous to the interests of the government.”⁶¹ Nevertheless, when Treasury officials expanded bill issuance in 1934, they simultaneously stopped offering certificates of indebtedness. By the end of 1934, bills were *the* short-term instrument of Treasury debt management.

6. CONCLUSION

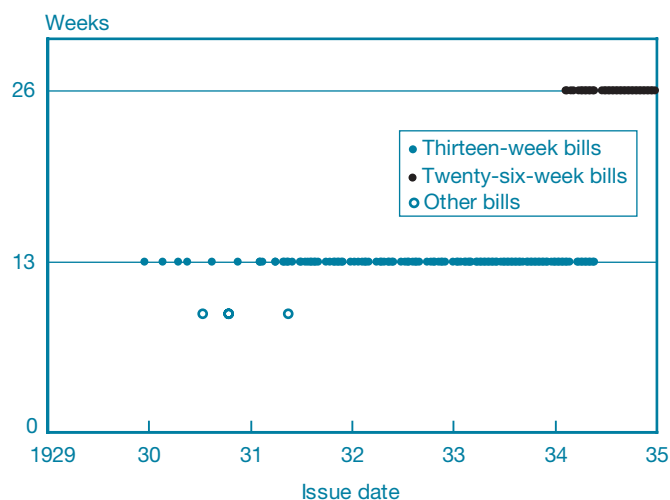
The U.S. Treasury began auctioning Treasury bills in 1929 to correct several flaws in the post-war structure of Treasury financing operations. The flaws included underpricing securities sold in fixed-price subscription offerings, infrequent financings that necessitated borrowing in advance of need, and payment with deposit credits that gave banks an added incentive to oversubscribe to new issues and contributed to the appearance of weak post-offering secondary markets for new issues.

All three flaws could have been addressed without introducing a new class of securities. For example, the Treasury could have begun auctioning certificates of indebtedness (instead of bills),⁶² it could have begun offering certificates

⁶¹ 1929 Treasury Annual Report, p. 275. See also the April 25, 1929, speech of Under Secretary Mills before the American Institute of Banking (1929 Treasury Annual Report, pp. 275-80, and “Mills Explains Aim of Treasury Bills,” *New York Times*, April 25, 1929, p. 42).

CHART 7

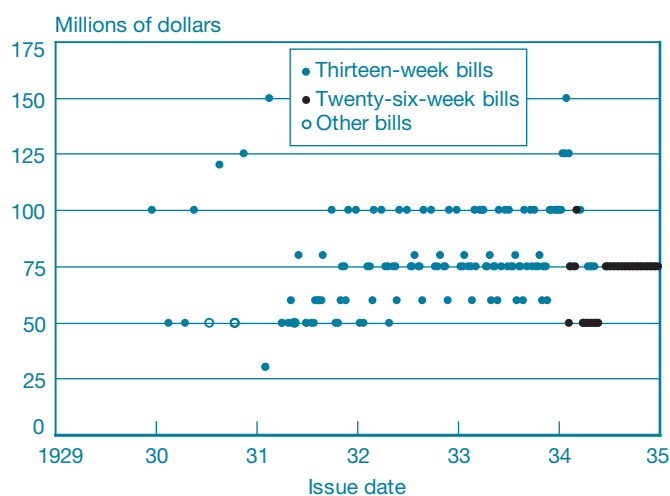
Term to Maturity of Treasury Bills



Source: Treasury annual reports.

CHART 8

Treasury Bill Amounts Issued

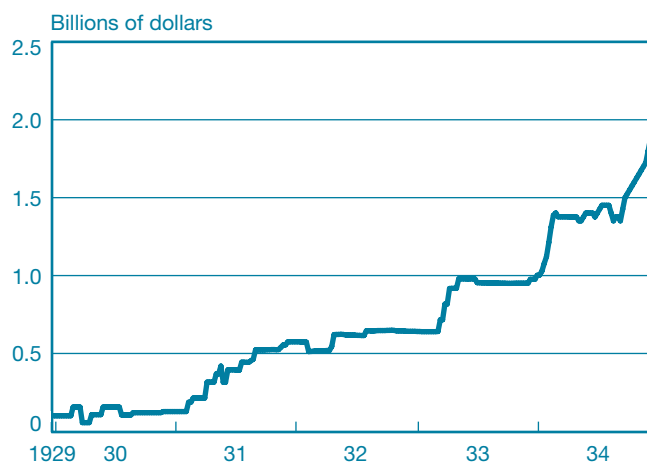


Source: Treasury annual reports.

⁶² However, the statutory restriction on selling certificates of indebtedness below par would have limited the ability of the Treasury to offer the securities in an auction format. A minimum price restriction nearly led to a failed bond auction in 1894 ("Carlisle Talks to Bankers," *New York Times*, January 30, 1894, p. 1, "Success Crowns the Loan," *New York Times*, February 1, 1894, p. 1, Barnes 1931, pp. 315–8, and Carosso 1987, p. 316) and contributed to a failed auction in 1973 (Garbade 2004, p. 38).

CHART 9

Aggregate Amount of Treasury Bills Outstanding



Source: Treasury annual reports.

between quarterly tax dates, and it could have begun selling certificates for immediately available funds. However, by introducing a new class of securities, the Treasury was able to address the defects in the existing primary market structure even as it continued to maintain that structure. If auction sales, tactical issuance, and settlement in immediately available funds proved successful, the new procedure could be expanded to notes and bonds.⁶³ If subsequent experience revealed an unanticipated flaw in the new procedure, however, the Treasury was free to return to exclusive reliance on regularly scheduled fixed-price subscription offerings and payment by credit to War Loan accounts. The introduction of Treasury bills in 1929 gave the Treasury an exit strategy—as well as a way forward—in the development of the primary market for Treasury securities.

⁶³ The Treasury initially continued to offer notes and bonds on a fixed-price subscription basis, and continued to receive large oversubscriptions to those offerings, following the introduction of Treasury bills. (As noted earlier, the Treasury suspended certificate sales in 1934.) It attempted to introduce an auction system for bond sales in 1935, but the effort floundered and the Treasury thereafter sold notes and bonds on a fixed-price subscription basis through the early 1960s. It tried—and failed—to introduce auction sales of bonds again in 1963 and finally succeeded on its third attempt in the early 1970s. See Garbade (2004).

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INTRADAY LIQUIDITY MANAGEMENT: A TALE OF GAMES BANKS PLAY

Morten L. Bech

Over the last few decades, most central banks, concerned about settlement risks inherent in payment netting systems, have implemented real-time gross settlement (RTGS) systems. Although RTGS systems can significantly reduce settlement risk, they require greater liquidity to smooth nonsynchronized payment flows. Thus, central banks typically provide intraday credit to member banks, either as collateralized credit or priced credit. Because intraday credit is costly for banks, how intraday liquidity is managed has become a competitive parameter in commercial banking and a policy concern of central banks. This article uses a game-theoretical framework to analyze the intraday liquidity management behavior of banks in an RTGS setting. The games played by banks depend on the intraday credit policy of the central bank and encompass two well-known paradigms in game theory: “the prisoner’s dilemma” and “the stag hunt.” The former strategy arises in a collateralized credit regime, where banks have an incentive to delay payments if intraday credit is expensive, an outcome that is socially inefficient. The latter strategy occurs in a priced credit regime, where postponement of payments can be socially efficient under certain circumstances. The author also discusses how several extensions of the framework affect the results, such as settlement risk, incomplete information, heterogeneity, and repeated play.

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AN ECONOMIC ANALYSIS OF LIQUIDITY-SAVING MECHANISMS

Antoine Martin and James McAndrews

A recent innovation in large-value payments systems has been the design and implementation of liquidity-saving mechanisms (LSMs), tools used in conjunction with real-time gross settlement (RTGS) systems. LSMs give system participants, such as banks, an option not offered by RTGS alone: they can queue their outgoing payments. Queued payments are released if some prespecified event occurs. LSMs can reduce the amount of central bank balances necessary to operate a payments system as well as quicken settlement. This article analyzes the performance of RTGS systems with and without the addition of an LSM. The authors find that, in terms of settling payments early, these mechanisms typically outperform pure RTGS systems. However, there are times when RTGS systems can be preferable to LSMs, such as when many banks that send payments early in RTGS choose to queue their payments when an LSM is available. The authors also show that the design of a liquidity-saving mechanism has important implications for the welfare of system participants, even in the absence of payment netting. In particular, the parameters specified determine whether the addition of an LSM increases or decreases welfare.

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GLOBAL TRENDS IN LARGE-VALUE PAYMENTS

Morten L. Bech, Christine Preisig, and Kimmo Soramäki

Globalization and technological innovation are two major forces affecting the financial system and its infrastructure. Perhaps nowhere are these trends more apparent than in the internationalization and automation of payments. While the effects of globalization and technological innovation are most obvious on retail payments, the influence is equally impressive on wholesale, or interbank, payments. Given the importance of payments and settlement systems to the smooth operation and resiliency of the financial system, it is important to understand the potential consequences of these developments. This article presents ten major long-range trends in the settlement of large-value payments worldwide. The trends are driven by technological innovation, structural changes in banking, and the evolution of central bank policies. The authors observe that banks, to balance risks and costs more effectively, are increasingly making large-value payments in real-time systems with advanced liquidity-management and liquidity-saving mechanisms. Moreover, banks are settling a larger number of foreign currencies directly in their home country by using offshore systems and settling a greater number of foreign exchange transactions in Continuous Linked Settlement Bank or through payment-versus-payment mechanisms in other systems. The study also shows that the service level of systems is improving, through enhancements such as longer operating hours and standardized risk management practices that adhere to common standards, while transaction fees are decreasing. Payments settled in large-value payments systems are more numerous, but on average of smaller value. Furthermore, the overall nominal total value of large-value payments is increasing, although the real value is declining.

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CHANGES IN THE TIMING DISTRIBUTION OF FEDWIRE FUNDS TRANSFERS

Olivier Armantier, Jeffrey Arnold, and James McAndrews

The Federal Reserve's Fedwire funds transfer service—the biggest large-value payments system in the United States—has long displayed a peak of activity in the late afternoon. Theory suggests that the concentration of late-afternoon Fedwire activity reflects coordination among participating banks to reduce liquidity costs, delay costs, and credit risk; as these costs and risk change over time, payment timing most likely will be affected. This article seeks to quantify how the changing environment in which Fedwire operates has affected the timing of payment value transferred within the system between 1998 and 2006. It finds that the peak of the timing distribution has become more concentrated, has shifted to later in the day, and has actually divided into two peaks. The authors suggest that these trends can be explained by a rise in the value of payments transferred over Fedwire, the settlement patterns of the private settlement institutions that use the system, and an increase in industry concentration. Although the study's results provide no specific evidence of heightened operational risk attributable to activity occurring later in the day, they point to a high level of interaction between Fedwire and private settlement institutions.

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THE TIMING AND FUNDING OF CHAPS STERLING PAYMENTS

Christopher Becher, Marco Galbiati, and Merxe Tudela

Real-time gross settlement (RTGS) systems such as CHAPS Sterling require large amounts of liquidity to support payment activity. To meet their liquidity needs, RTGS participants borrow from the central bank or rely on incoming payments from other participants. Both options can prove costly—the latter in particular if participants delay outgoing payments until incoming ones arrive. This article presents an empirical analysis of the timing and funding of payments in CHAPS. The authors seek to identify the factors driving the intraday profile of payment activity and the extent to which incoming funds are used as a funding source, a process known as liquidity recycling. They show that the level of liquidity recycling in CHAPS is high and stable throughout the day, and attribute this result to several features of the system. First, the settlement of time-critical payments provides liquidity to the system early in the settlement day; this liquidity can be recycled for the funding of less urgent payments. Second, CHAPS throughput guidelines provide a centralized coordination mechanism, in effect limiting any tendency toward payment delay. Third, the relatively small direct membership of CHAPS facilitates coordination between members, for example, through the use of bilateral net sender limits. Coordination encourages banks to maintain a relatively constant flux of payments throughout the day. The authors also argue that the high level of recycling helps to reduce liquidity risk, and that the relatively smooth intraday distribution of payments serves to mitigate operational risk associated with highly concentrated payment activity. They note, however, that the benefits of liquidity recycling are not evenly distributed between members of CHAPS.

UNDERSTANDING RISK MANAGEMENT IN EMERGING RETAIL PAYMENTS

Michele Braun, James McAndrews, William Roberds, and Richard Sullivan

New technologies used in payment methods can reduce risk, but they can also lead to new risks. Emerging retail payments are prone to operational and fraud risks, especially security breaches and potential use in illicit transactions. This article describes an economic framework for understanding risk control in retail payments. Risk control is a special type of good because it can protect one payment participant without diminishing the protection of other participants. As a result, the authors' economic framework emphasizes risk containment, primarily through the establishment and enforcement of risk management policies. Application of the framework to three types of emerging payments suggests that a payments system can successfully manage risk if it quickly recognizes problems, encourages commitment from all participants to control risk, and uses an appropriate mix of market and public policy mechanisms to align risk management incentives. The authors conclude that providers of emerging payment methods must mitigate risk effectively or face rejection in the payment market.

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AN ECONOMIC PERSPECTIVE ON THE ENFORCEMENT OF CREDIT ARRANGEMENTS: THE CASE OF DAYLIGHT OVERDRAFTS IN FEDWIRE

Antoine Martin and David C. Mills

A fundamental concern for any lender is credit risk—the risk that a borrower will fail to fully repay a loan as expected. Thus, lenders want credit arrangements that are designed to compensate them for—and help them effectively manage—this type of risk. In certain situations, central banks engage in credit arrangements as lenders to banks, so they must manage their exposure to credit risk. This article discusses how the Federal Reserve manages its credit risk exposure associated with daylight overdrafts. The authors first present a simple economic framework for thinking about the causes of credit risk and the possible tools that lenders have to help them manage it. They then apply this framework to the Federal Reserve’s Payments System Risk policy, which specifies the use of a variety of tools to manage credit risk. The study also analyzes a possible increase in the use of collateral as a credit risk management tool, as presented in a recent proposal by the Federal Reserve concerning changes to the Payments System Risk policy.

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FINANCIAL SECTOR FDI AND HOST COUNTRIES: NEW AND OLD LESSONS

Linda S. Goldberg

Foreign direct investment (FDI) into the financial sectors of emerging economies soared during the 1990s, leaving many countries with banking sectors owned primarily by foreign institutions. While the implications of FDI into emerging markets are well documented, less clearly understood is how the host countries are affected by financial sector FDI specifically. An understanding of this relationship is crucial for countries formulating policy with respect to foreign banks. This article argues that many lessons learned from work on FDI into manufacturing and primary resource industries apply directly to host-country financial sectors. The author provides evidence on such themes as technology transfers, productivity spillovers, wage effects, macroeconomic growth, and fiscal policy to show that financial sector FDI into emerging markets generally has positive effects on the host countries. In banking and finance specifically, she argues that financial sector FDI can potentially strengthen institutional development through improvements to regulation and supervision.

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AN EXAMINATION OF TREASURY TERM INVESTMENT INTEREST RATES

Warren B. Hrungr

In November 2003, the Term Investment Option (TIO) program became an official cash management tool of the U.S. Treasury Department. Through TIO, the Treasury lends funds to banks for a set number of days at an interest rate determined by a single-rate auction. One reason why the Treasury introduced TIO was to try to earn a market rate of return on its excess cash balances. This article studies 166 TIO auctions from November 2003 to February 2006 to determine how TIO interest rates have compared with market rates. The author investigates the spread between TIO rates and rates on mortgage-backed-security repos, a close benchmark for TIO rates. He finds that aside from offerings with very short term lengths, the Treasury receives an interest rate on TIO auctions comparable to market rates. He also documents a negative relationship between an auction's size and the spread between TIO and repo rates. Furthermore, the Treasury's announcement and auctioning of funds on the same day does not adversely affect rate spreads, a finding that suggests that banks are indifferent to more advance notice of TIO auctions.

TRENDS IN FINANCIAL MARKET CONCENTRATION AND THEIR IMPLICATIONS FOR MARKET STABILITY

Nicola Cetorelli, Beverly Hirtle, Donald Morgan, Stavros Peristiani, and João Santos

The link between financial market concentration and stability is a topic of great interest to policymakers and other market participants. Are concentrated markets—those where a relatively small number of firms hold large market shares—inherently more prone to disruption? This article considers that question by drawing on academic studies as well as introducing new analysis. Like other researchers, the authors find an ambiguous relationship between concentration and instability when a large firm in a concentrated market fails. In a complementary review of concentration trends across a number of specific markets, the authors document that most U.S. wholesale credit and capital markets are only moderately concentrated, and that concentration trends are mixed—rising in some markets and falling in others. The article also identifies market characteristics that might lead to greater, or less, concern about the consequences of a large firm’s exit. It argues that the ease of substitution by other firms in concentrated markets is a critical factor supporting market resiliency.

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THE EMERGENCE OF “REGULAR AND PREDICTABLE” AS A TREASURY DEBT MANAGEMENT STRATEGY

Kenneth D. Garbade

During the 1970s, U.S. Treasury officials revised the framework within which they selected the maturities of new notes and bonds. Previously, they chose maturities on an offering-by-offering basis. By 1982, the Treasury had ceased these “tactical” sales and was selling notes and bonds on a “regular and predictable” schedule. This article describes that key change in the Treasury’s debt management strategy. The author shows that in 1975, Treasury officials financed an unusually rapid expansion of the federal deficit with a flurry of tactical offerings. Because the timing and maturities of the offerings followed no predictable pattern, the sales sometimes took investors by surprise, disrupting the market. These events led Treasury officials to embrace a more regularized program of regular and predictable issuance—a program they had been using for decades to auction bills. The Treasury’s switch to regular and predictable issuance of notes and bonds was widely praised for reducing the element of surprise in Treasury offering announcements, facilitating investor planning, and decreasing Treasury borrowing costs.

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NEW DIRECTIONS FOR UNDERSTANDING SYSTEMIC RISK

A Report on a Conference Cosponsored by the Federal Reserve Bank of New York
and the National Academy of Sciences, May 18-19, 2006.

HEDGE FUNDS, FINANCIAL INTERMEDIATION, AND SYSTEMIC RISK

John Kambhu, Til Schuermann, and Kevin J. Stiroh

Hedge funds, with assets under management exceeding an estimated \$1 trillion in 2006, have become important players in the U.S. and global capital markets. These largely unregulated funds differ from other market participants in their use of a variety of complex trading strategies and instruments, in their liberal use of leverage, in their opacity to outsiders, and in their convex compensation structure. These differences can exacerbate market failures associated with agency problems, externalities, and moral hazard.

Counterparty credit risk management (CCRM) practices, used by financial institutions to assess credit risk and limit counterparty exposure, are the first line of defense against market disruptions with potential systemic consequences. This article examines how the unique nature of hedge funds may generate market failures that make CCRM for exposures to the funds intrinsically more difficult to manage, both for regulated institutions and for policymakers concerned with systemic risk. The authors acknowledge that various market failures, such as the one linked to the 1998 collapse of hedge fund Long-Term Capital Management, may make CCRM imperfect. However, CCRM has improved significantly since then, and it remains the appropriate starting point for limiting the potential for hedge funds to generate systemic disruptions.

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A COMPARISON OF MEASURES OF CORE INFLATION

Robert Rich and Charles Steindel

The ability of central banks to differentiate between permanent and transitory price movements is critical for the conduct of monetary policy. The importance of gauging the persistence of price changes in a timely manner has led to the development of measures of underlying, or “core,” inflation that are designed to remove transitory price changes from aggregate inflation data. Given the usefulness of this information to policymakers, there is a surprising lack of consensus on a preferred measure of U.S. core inflation.

This article examines several proposed measures of core inflation—the popular ex food and energy series, an ex energy series, a weighted median series, and an exponentially smoothed series—to identify a “best” measure. The authors evaluate the measures’ performance according to criteria such as ease of design and accuracy in tracking trend inflation, as well as explanatory content for within-sample and out-of-sample movements in aggregate CPI and PCE inflation. The study reveals that the candidate series perform very differently across aggregate inflation measures, criteria, and sample periods. The authors therefore find no compelling evidence to focus on one particular measure of core inflation, including the series that excludes food and energy prices. They attribute their results to the design of the individual measures and the measures’ inability to account for variability in the nature and sources of transitory price movements.

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THE ROLE OF RETAIL BANKING IN THE U.S. BANKING INDUSTRY: RISK, RETURN, AND INDUSTRY STRUCTURE

Timothy Clark, Astrid Dick, Beverly Hirtle, Kevin Stiroh, and Robard Williams

The U.S. banking industry is experiencing a renewed interest in retail banking, broadly defined as the range of products and services provided to consumers and small businesses. This article documents the “return to retail” in the U.S. banking industry and offers some insight into why the shift has occurred. At the bank level, the principal attraction of retail banking seems to be the belief that its revenues are stable and thus can offset volatility in nonretail businesses. At the industry level, the authors show that interest in retail activities fluctuates in rather predictable ways with the performance of nonretail banking and financial market activities. They document the features that the recent “return to retail” has in common with past cycles, but also identify factors suggesting that this episode may be more persistent. The most important of these factors is the role of large banks: this retail banking cycle is being driven almost entirely by the very largest U.S. banking firms. The key role of very large banks gives extra weight to this retail banking episode. [EPR Executive Summary available](#)

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