Review of Ricardian Equivalence: Theoretical and Empirical Studies

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I. Introduction

In recent years, huge amount of government debts or federal deficits have generated widespread public interest and political debate in many countries. People seem to believe that government debt is one of the main reasons of inflation, unemployment and economic recessions. But the effects of government debt on the economy are not obvious from either economic theory or results of empirical studies.

There are two main streams to deal with this aspect of research. The first stream is of Keynesian position. The assertion is that an increase in debt due to the tax cuts raises disposable income and stimulates aggregate demand and as a result, the debt causes higher interest rates and crowds out private investment. The second stream is of Ricardian’s prospect. According to Ricardian equivalence, the economic agents regard present tax cuts as future tax burden because the agents are assumed to be foresighted. The agents realize that present value of taxes depends on real government spending, not on the timing of taxes. Therefore an increase in debt can not stimulate the aggregate demand, and as a result, the increase in debt has no real effects. In large part, this second view has been attributed to the work of Barro (1974).

Since the suggestions of Ricardian equivalence have several important as well as controversial implications, I briefly review the concept of Ricardian equivalence here. The Keynesian approach is based on an assumption that the agents decide their consumptions on current income. But, from an Ricardian’s assertion, when the agents are looking forward to and are fully aware of the government’s intertemporal budget constraint, they will anticipate that tax cuts today will result in higher taxes being
imposed on their future generation. Hence the agents who take care of their descendants’ utilities as well as their own, will not increase their consumption based on increased current disposable income due to today’s tax cuts (Barro, 1974). With the assumption of free access to credit market, the agents decide their consumption based on permanent income which is not affected by the timing of taxes (Barro, 1974). Thus, there is Ricardian equivalence between taxes and debt. Perfect Ricardian equivalence implies that a reduction in government saving due to tax cuts is fully offset by higher private saving, so the aggregate demand is not affected.

In this paper, I review the literatures presenting different results of studies about Ricardian equivalence. First, I review the debate associated with the theoretical problems about Ricardian equivalence, second, I review the empirical studies testing the validity of Ricardian equivalence. My focus on those empirical studies is given to the consumption function test which is one of the main studies about real variable.
II. Literature Review

I. The theoretical issues associated with Ricardian equivalence

The main logic of Ricardian is that deficits correspond only to postponement of taxes. This logic results the indifference between paying one dollar for taxes in current period and paying one dollar plus interest in future period\(^1\). Since the timing of taxes does not change the agents’ permanent income or lifetime budget constraint, a change in timing of taxes can not alter their consumption decisions.

Economists who criticize this Ricardian proposition claim that the logic is only valid when the agent lives forever, which means the logic depends on the length of agent’s planning horizons. If the agent realizes that the government will collect the postponed taxes after he dies, then his consumption decisions may alter (Diamond, 1965). Regarding this criticism, Barro (1974) adopts the intergenerational altruism to extend the agent’s planning horizons. According to Barro (1974), although the parents realize that the postponed taxes will be collected after they die, they will not increase their consumption simply due to their increased disposable income. This is because the parents take care their children’s welfare, and the parents know that their children will pay higher taxes to compensate the deficits. Hence the parents save more instead of consuming more, and leave larger bequests to their children to help pay higher taxes in the future. Therefore each generation’s planning period is extended to infinite horizon if each generation cares its next generation’s welfare and each generation leaves an altruistic

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\(^1\) Ricardian proposition assumes that the agents are rational and foresighted.
bequest to its children. Hence Barro’s finding suggests that Ricardian equivalence is reinstated.

Nevertheless of Borro’s work, there are still many debates concerning with Ricardian’s theoretical framework. In this section, I review several confliction issues, which are being favorable or unfavorable to Ricardian equivalence.

1.1 The linkage between generations

To extend each generation’s horizon into infinite, the ubiquitous altruistic bequest is needed as a linkage between generations. Some economists (e.g. Feldstein 1988) doubt that there exists such an intra-family transfer between family members. Their suspicions roughly come from two standpoints. The first point is whether the significant intergenerational transfers always exist. The second point is whether the motive of bequests is altruistic or non-altruistic.

One simple critic about the first point above - the possibility of existence of ubiquitous transfers - is that the existence may become subtle depending on the presence of childless families. According to Seater (1993), about a fifth of all families are childless in a permanent sense. The childless families have little concern for taxes levied on future generation, and they change their consumption decisions when the government swaps debt for taxes. Since families with children realize that the childless families’ consumption decisions increase the next generation’s burden of taxes, families with children try to offset the economic effects caused by decisions of childless families by
leaving more bequests to the children (Barro 1989). However, the offset is likely to be incomplete, Ricardian equivalence can be violated\textsuperscript{2}. But economists like Seater (1993) support the assumption of ubiquitous. Although Seater accepts that the fraction of childless families is substantial as well as its impact on Ricardian equivalence, he claims there is not enough evidence to reject Ricardian proposition because of the existence of childless families. This is because we can’t estimate the magnitude of the impact of childless families’ decisions to Ricardian equivalence\textsuperscript{3}, and we don’t have evidence to measure how great the offset by the families with children is either. Therefore, Seater claims that we can not conclude whether the existence of childless families is a critical and possible source to reject Ricardian equivalence.

The second issue is whether the motive of bequest is altruistic or something else. Altruism is an important proposition for Ricardian equivalence because if parents are not altruistic in the infinite horizon model, they will change their economic decisions in response to government deficit policies, and they will not leave enough bequests to their children to help pay higher taxes in the future. The studies about the motive of bequest show conflicting results. Some findings are consistent with altruism (e.g. Seater 1993), other findings are inconsistent with altruism (e.g. Bernheim 1987).

1.2 The liquidity constraints

To hold Ricardian equivalence, the economic agents are assumed to access capital

\textsuperscript{2} See Seater (1993), p.151

\textsuperscript{3} This is because we don’t have any statistics on the income distribution. For example, if childless families are wealthy, they will have more impact on Ricardian equivalence (Seater 1993).
market without any constraint to borrow money whenever they need. This assumption helps the agents to make their economic decisions upon their permanent income, hence their economic behaviors including consumption decisions will not alter much in response to the external shocks such as changes in government policies and current income.

The critics of Ricardian equivalence claim that most microeconometric evidence suggests that some households are liquidity constrained. For example, Cox and Jappelli (1990) suggest that about twelve or eighteen percent of consumers are liquidity constrained. Many studies show the results that liquidity constraints affect an appreciable number of households. Bernheim (1987) introduces King’s (1983) and Hayashi’s (1985) results to show that liquidity constraints alter consumers’ behavior: the results suggest that a sizable minority, roughly twenty percent, of consumers’ decisions are inconsistent with those when there are no liquidity constraints.

Seater and Mariano’s (1985) work shows different results. They test excess sensitivity of consumption, which can be interpreted as an existence of effect due to liquidity constraints. They find evidence of excess sensitivity, but no evidence of significant effect of government financing variables on consumption. Seater (1993) also introduces Hayashi’s result (1985) that liquidity constraints reduce average consumption by only two point seven percent in the United States, which seems negligible.

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4 Based on the data from the Survey of Consumer Finances which identifies individuals who have been denied credit (Seater 1993), p.151
1.3 Other issues

There are more issues being related to Ricardian proposition. Those are on the assumptions of lumpsum taxation, certainty, and foresightness in consumers.

The assumption of lumpsum taxation in Ricardian framework may not be plausible since the distortionary taxation like income taxes changes the relative prices and it also affects the timing of taxes. For example, suppose government reduces current marginal tax rates and increases debt. This change in government fiscal policy accompanies an expectation that future marginal tax rates will rise in the future to compensate the debt. This change in timing of taxation also alters intertemporal substitution effects which affects the economic decisions. Therefore, the change in timing of taxation makes Ricardian equivalence fail. But Seater (1993) asserts an opposite opinion. He argues that the substitution effects and related changes in decisions arise from the changes in the path of marginal tax rates. He claims that the only point which Ricardian equivalence concerns is the effect of the path of the debt, not the effect of the path of marginal tax rates. Hence there is no necessity to conclude a failure of Ricardian equivalence because of the distortionary taxation. Suppose there is a multiple regression system about Ricardian equivalence which includes variables for the debt, current and expected marginal tax rates. Ricardian equivalence implies that the debt coefficient is zero. Ricardian equivalence has no implication for the marginal tax rates coefficients because only debt coefficient is relevant (Seater 1993).
Uncertainty is generally ignored in Ricardian framework. Feldstein (1988) considers uncertainty in parents’ future income in his work, and he shows Ricardian equivalence fails. Since the parents are uncertain about their future income, they can not decide how much amount of bequest should be left. Because of this problem, parents are not indifferent between today’s one dollar in their hands and a future payment to their children, which has a present value of one dollar. As a result, Ricardian equivalence can not hold.

Individuals are supposed to be foresighted and rational to hold Ricardian equivalence. There are some skeptics about this proposition. First, consumers may choose their consumptions simply according to their current disposable income, and they also fail to compare the value of increased current income to future tax burden. Then consumers’ decision will alter and it causes to violate Ricardian equivalence. These skeptical positions connote that consumers are imperfect to perceive tax implication of government spending or debt. For example, it is possible that consumers will distinguish between permanent and temporary changes in taxes, but they will not recognize the taxes implied by government debt (Modigliani and Sterling 1990). There are some supports for the assumption of foresight, as Seater (1993)⁶, but this behavioral assumption seems very strong.

⁶ He argues the positions of the skeptics which consider consumers very naïve about tax implications of government debt. He claims the logic of PILCH(permanent income and life cycle hypothesis) can apply to this behavioral assumption. pp.154-155
2. The empirical results associated with Ricardian equivalence

2.1 The problems of measurement and methodology.

Many empirical studies show big differences to each other, some are favorable or some others are unfavorable to Ricardian equivalence. These conflicting results seem to come out due to the econometric reasons (e.g. Aschauer 1985). This means that estimation results are very sensitive to measurement and methodological issues. Especially, misspecification, omitted variables, or endogeneity problems may lead to biased estimates of some coefficients (e.g. Feldstein 1982, Aschauer 1985 ). Therefore, I briefly review these aspects before presenting empirical results.

First, measurement of debts and deficits is problematic. For example, the total stock of government debt or the total deficit is to be used in empirical work, but studies usually use only the federal level of debt (Seater 1993). As Seater points out, this fact may lead to biased estimates because it disregards possible correlations between federal and local level of debt, besides omitting relevant information.

Second, several econometric methodologies are the sources of leading biased estimates. When economists make models, it does not seem simple to capture and all proper variables into the models since there are many cases to debate about misspecified or omitted variables (e.g. Aschauer 1985, Graham 1993). Deficits can be an endogenous variable if it is affected by the economy’s situation or by unexpected need for high government expenditure. Also it is difficult to distinguish between the effects of different policy variables.
From the reasons above, we have many conflicting results about Ricardian equivalence. I choose several literatures including four main literatures\textsuperscript{7} which induce many responses from following studies, to introduce the conflicting empirical results about Ricardian equivalence\textsuperscript{8}. As I mentioned in the “introduction” section, the focus of my review is on the consumption function test.

2.2 Conflicting findings from empirical studies

Feldstein (1982) rejects Ricardian equivalence in his test using the following equation:

\[ C_t = a_0 + a_1 Y_t + a_2 W_t + a_3 SSW_t + a_4 G_t + a_5 T_t + a_6 TR_t + a_7 D_t + e_t \]  \hspace{1cm} (1)

where \( C \) is total consumer expenditure, \( Y \) is current income, \( W \) is the market value of privately owned wealth, \( SSW \) is a measure of the value of future Social Security benefits, \( G \) is total government purchases, \( T \) is total tax revenues, \( TR \) is government transfers to individuals, \( D \) is total government debts and \( e \) is the residual. Feldstein argues that five conditions about the coefficients in (1) should be hold to accept Ricardian equivalence, which are \( a_4 < 0, a_5 = 0, a_6 = 0, a_3 = 0 \), and \( a_2 = a_7 \). He uses OLS and 2SLS to test (1). In the OLS estimates, he rejects only one condition, \( a_6 = 0 \), with the t-test. Using 2SLS,

\textsuperscript{7} Martin Feldstein (1982), Roger Kormendi (1983), David Aschauer(1985), and Fred Graham (1993).

\textsuperscript{8} This chronicle method may be better to compare the contrary opinions than categorizing two groups, favorable and unfavorable to Ricardian equivalence.
he rejects four of the five conditions, $a_4 < 0$, $a_5 = 0$, $a_6 = 0$, and $a_2 = a_7$. Therefore he rejects Ricardian equivalence\(^9\).

Aschauer (1985) criticizes Feldstein’s results, which treat current income as exogenous because this treatment induces endogeneity problem. Although Feldstein employs instrumental variable to correct this problem using once-lagged values of income and taxes, Aschauer claims that the bias from the endogeneity problem may not fully be eliminated by the instruments. Seater (1993) points out the inconsistency of Feldstein’s criteria for interpretation of the results. Although four of the five OLS test are consistent with Ricardian equivalence, Feldstein does not accept Ricardian equivalence since he argues that the results are mixed and unclear. In contrast, he rejects Ricardian equivalence with the 2SLS result – four of the five tests are inconsistent with Ricardian equivalence – since he argues that the estimated parameters contradict the Ricardian hypothesis. But Feldstein’s study has valuable features. One of them is that his work appears to be the first to attempt to correct the simultaneity problem and his work also appears to be the first to recognize the logical generalizations which should accompany Ricardian equivalence (Seater 1993).

Kormendi (1983) uses what he calls the “consolidated” approach for his empirical research. The good feature of his consolidated approach based on the permanent income hypothesis is that it can embrace the previous tests of Ricardian equivalence based on the

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\(^9\) Feldstein shows that uncertainty in the future income can fail Ricardian equivalence because parents cannot decide the amount of bequest – saving – in current period due to the uncertainty in their future income (1988). But Ricardian equivalence can hold regardless of income uncertainty if positive amount of bequests always exist.
permanent income/life cycle model of consumption. His consumption function is as follows,

$$PC_t = a_0 + a_1Y_t + a_2GS_t + a_3W_t + a_4TR_t + a_5TX_t + a_6RE_t + a_7GINT_t + a_8GB_t + u_t$$  \( (2) \)

where PC is private consumption, Y is total income, GS is total government spending, W is total wealth, TR is transfers, TX is tax revenue, RE is retained earnings, GINT is government interest payments on outstanding debt, GB is the stock of government bonds, and u is the residual. This consolidated approach can be compared with the “standard” approach being used in previous studies, which considers consumption to be decided by disposable income, YD, and total wealth plus government debt, GB (u is the residual):

$$PC_t = a_0 + a_1YD_t + a_2(W_t + GB_t) + u_t$$

This standard approach has some flaws. First, this approach treats government debt as the same coefficient with wealth. However, debt needs to be separated into unique variables since government debt is a liability term and has its own effect on consumption. Under permanent income hypothesis, the size of debt does not influence consumption. Second, the standard approach ignores the effect of government expenditure on consumption. If Ricardian equivalence holds, we can predict the signs of each coefficients under the consolidated approach as follows: \( a_2 < 0, a_4 = a_5 = a_6 = a_7 = a_8 = 0 \). Also we can expect that \( a_2 = 0, a_4 = -a_5 = a_6 = a_7 = a_8 > 0 \) under the standard approach. Kormendi and Meguire’s (1990) results are consistent with the consolidated approach’s hypothesis.
on the consumption function’s coefficients, and their results reject the coefficient restrictions under the standard approach. Therefore, the results support Ricardian equivalence.

There are several responses to Kormendi and Meguire’s (1990) results. Modigliani and Sterling argue for short sample periods which does not include the data of World War II (1990). They also suggest that Ricardian equivalence may fail when temporary tax variables are included in regression function (1986). A criticism can be given to the estimation of permanent income being composed of physical and human capital. Kormendi adopts education spending to measure the human capital, but it may have limit to measure accurate human capital. But many replications support Kormendi’s (1983), Kormendi and Meguire’s (1990) works and their works is regarded to supercede the previous works on the life cycle approach to Ricardian equivalence (Seater 1993).

Aschauer (1985) asserts that the existence of a misspecification bias leads to conflicting results, and he attempts to measure effects more accurately by adjusting this bias. He claims that he abandons the conventional methodology in previous studies and instead uses the Euler equations directly, which comes from the first-order condition derived from consumer’s utility maximization problem. Aschauer’s consumption function derived from Euler equation. The equation is as follows:

\[ C_t = \alpha + \beta C_{t-1} + \beta \theta G_{t-1} - \theta E_{r-1} G_t + u_t \]

\[ G_t = \gamma + \varepsilon_1 G_{t-1} + \ldots + \varepsilon_n G_{t-n} + \omega_1 D_1 + \ldots + \omega_m D_m + v_t \]
where $C$ is per capita consumer expenditure, $G$ is per capita government expenditure, $D$ is per capita government deficit, and $u$ and $v$ are unexpected shocks. Based on this Euler equation approach, he comes to the following conclusions: (i) government expenditure substitutes poorly ($\theta^{10} = 23\text{-}42\%$) for private consumption, and (ii) joint hypothesis of rational expectation and Ricardian equivalence holds. There are several good features in Aschauer’s (1985) paper. His consumption function test is based on a microeconomic model, and his consumption function test does not try to measure lifetime wealth, which is hard to do. In addition, he incorporates the permanent income hypothesis without measuring permanent income. He adopts Hall’s (1978) idea that one-period lagged consumption has enough information to capture the permanent income.

Graham (1993) criticizes Aschauer’s (1985) results in several reasons. Graham claims that Aschauer’s weakness stems from the omission of the disposable income in the model and the use of government spending as an aggregate measure$^{11}$. Graham uses the equation as follows:

$$
\Delta C_t = \alpha - \theta \Delta G_t + \lambda \Delta Y_t + e_t \quad (3)
$$

where $C$ is per capita private consumption, $G$ is per capita government spending, $Y$ is per capita disposable income, $\Delta$ is the first-difference operator, and $e$ is a disturbance term. If $\lambda$ in equation (3) is restricted to zero, we can not reject Ricardian equivalence. Using

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$^{10}$ Aschauer sets $C_t^* = C_t + \theta G_t$, where $C_t^*$ is effective consumption and $\theta$ is substitutability between private consumption and government goods and services.

$^{11}$ The aggregate measure of government spending can influence the private consumption.
equation (3), Graham shows that Aschauer’s findings are only valid during a certain period because Aschauer’s findings are altered when alternative periods are considered. Graham concludes that Ricardian equivalence does not hold because he finds significant relationship between disposable income and private consumption. (He reports coefficient $\lambda = 0.299 - 0.458$). He also shows that the coefficient for the substitutability between private consumption and government expenditure has a wide range during the test period. (He reports coefficient $\theta = -1.245 - 0.183$). He asserts the wide range of $\theta$ is due to the fact that $\theta$ can be different depending on the type of government purchase. This means that some government spending is the substitutes to private consumption, but some others may not. He categorizes government spending in three types, federal defence spending, federal nondefence spending, and state and local spending. He finds that only federal nondefence spending has substitute effect on private consumption.

In response to Graham’s comments, Aschauer (1993) emphasizes his original intention, which was to determine whether there is a substitution relationship between government spending and private consumption. He claims that his permanent income approach does not necessarily mean the relationship should remain same for different periods. Aschauer also refutes Graham’s assertion-change in disposable income results changes in private consumption- since this is not enough to support the Keynesian prospective. To see whether changes in taxes lead to changes in private consumption, Aschauer considers the model (4) as follows:

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\Delta C_t = \alpha - \theta \Delta G_t + \lambda \Delta Y_t - \phi \Delta T_t + e_t, \quad (4)
$$
where $C$ private consumption spending, $G$ is government spending, $Y$ is gross income, and $T$ is the level of taxes. He estimates this equation (4) with the same instruments used by Graham. Then, he show two results. The first one is that he finds the fairly narrow range of $\theta$ ($\theta=0.110-0.137$). The second result is that the tax variable has less statistical significance than the aggregate government spending variable. This second finding implies that the Keynesian view on tax cuts stimulating consumption is rejected, and Ricardian equivalence holds.

2.3 Other test; fiscal multiplier test in general equilibrium models

Since the early 1980’s, a number of studies have used dynamic general equilibrium models to analyze the steady-state effects of fiscal policy. One of them is Baxter and King (1993). Their main findings are as follows: (i) permanent changes in government consumption have larger output effects than temporary changes. The main reason is that permanent changes in spending will increase the long-run capital stock and result a large increase in investment, while temporary changes result in more crowding output with a smaller output response, (ii) permanent changes in government spending can lead to output multiplier that exceed one in long-run as well as in short-run.
References


