Macroeconomic Hydraulics Reconsidered: Teaching Leakages and Injections from the Classical Perspective

Ben L. Kyer and Gary E. Maggs*

ABSTRACT

This paper offers a pedagogical alternative to the familiar Keynesian analysis of leakages and injections based on the Classical school. In doing so, the paper posits that the Classical analysis provides a mirror image of the Keynesian approach, i.e., where the flows constituting leakages in the Keynesian system are analogous to injections in the Classical school. Furthermore, the paper shows that a disequilibrium situation in the bond market causes bond prices to move in a direction precisely opposite that of real gross domestic product when a similar goods market disequilibrium occur.

Introduction

Since its introduction by Samuelson in 1948[1], the leakages and injections analysis has become an important component of many popular textbooks at both the principles and intermediate levels of macroeconomics. The pedagogical treatment of "hydraulic Keynesianism", at least to our knowledge, has historically always been set in the context of the commodity market where the various structural flows of saving, investment, government spending, tax revenue, exports and imports determine, with the "Keynesian cross diagram", the aggregate flow variable of real gross domestic product. Within the Classical school[2], however, the equilibrium and full-employment level of real gross domestic product is entirely a function of a vertical aggregate supply curve and, therefore, leakages and injections should be interpreted from a different perspective and determine a different and distinct aggregate variable. We believe that the Classical school would view leakages and injections through the lens of the bond market in which the variable determined by the countervailing flows is the price of bonds. While an analysis of the bond market--sometimes referred to as the capital market or market for loanable funds --is a common way to teach interest rate determination, we know of no previous attempt to contextualize the bond market in hydraulic

*The authors are, respectively, The Benjamin Wall Ingram, III, Professor of Economics, Francis Marion University, Florence, SC, and Professor of Economics, St. John Fisher College, Rochester, NY. We thank two anonymous referees for helpful suggestions and guidance. Any errors which remain are ours only. Corresponding author email: BKyer@fmarion.edu.

[1] See Samuelson, 1948, page 264.

[2] The name "Classical school", which according to Keynes was coined by Marx and referred to Ricardo and his predecessors, is used here to refer to expositions found in such modern textbooks as Abel, Bernanke and Croushore, Dornbusch, Fischer and Startz, and Mankiw. To a certain extent today, "Classical school" has become a kind of straw man since some Classical writers, such as J.R. McCulloch and Lord Overstone (Samuel Jones-Loyd), recognized that real gross domestic product could deviate from the long-run and full-employment equilibrium level.

terms or to compare the standard Keynesian treatment of leakages and injections to a Classical perspective.[3] This paper, therefore, offers an approach to teaching macroeconomic hydraulics that is based on the theoretical foundations of the Classical school. This approach that focuses on the bond market utilizes the basic and familiar hydraulic analysis, preserves the Classical dichotomy, and is effectively a mirror image of the standard Keynesian analysis. An example of this mirror image is while Keynesians view saving as a leakage from the expenditure stream which, in excess of investment, decreases equilibrium real gdp,[4] Classical economists would see the same excess of savings as an injection into the bond market that increases bond prices.

The paper proceeds with Section II presenting the various analyses of leakages and injections from the alternative Classical perspective. We begin with a simple private, closed economy, an economic sphere where there is absent a public and an international sector. We then add government spending and taxation which allows us to consider the hydraulic implications of budgetary imbalances. Finally, we introduce international trade to extend the analysis and consider the effect of balance of trade surpluses or deficits on the bond market flows. Section III concludes by providing a summary of the results and a statement of the contributions of our paper.

The Analysis

A Simple Economy

We begin by assuming an economy having neither a government nor an international sector, so the only flows to consider emanate from saving and investment. Saving, or current income not spent is, of course, a Keynesian leakage from the spending flow in the real economy. It is then explained that this saving must leak or flow somewhere, i.e., it doesn't just disappear. The Classical school would then alternately argue that saving is an injection or inflow of dollars to the bond market via a demand for bonds since in their view rational economic agents would hold bonds rather than cash balances as an asset because money is strictly a medium of exchange that pays a zero rate of interest. For simplicity, we assume that only individuals save and that the only alternative asset which individuals can hold is bonds. Therefore saving (S) is equal to the demand for bonds D^B,[5] and the quantity of bonds demanded is inversely related to the price of bonds P^B.

The interpretation of aggregate investment by Keynesians as an injection to the real economy follows directly from its definition as an expenditure by business firms on buildings and equipment. The Classical writers would respond that most investment is financed by borrowing rather than by internal funds since the acquired capital goods provide a rate of return greater than their own saving. This borrowing for investment by issuing bonds represents a leakage or an outflow of dollars from the bond market. Again for simplicity, we assume that investment is unique to business, i.e., the only asset business firms can hold is physical

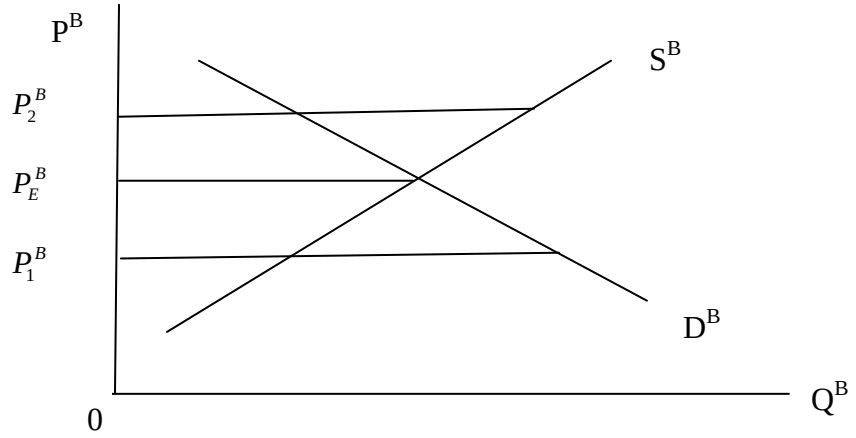
[3]Mankiw perhaps comes closest to our intent in this paper. While he acknowledges that "the flows into the financial markets (private and public saving) must balance the flows out of the financial markets (investment)" for equilibrium, he does not use the terms leakages and injections and does not frame his analysis in the context of "hydraulics" or water flow dynamics. Additionally, Mankiw presents his analysis in terms of the market for loanable funds but, when this approach is used, the hydraulic analysis doesn't "work". That is, by using the loanable funds market rather than the bond market, an excess of injections or savings/supply of loanable funds over leakages or investment/ demand for loanable funds results in a lower equilibrium interest rate, precisely the opposite conclusion of what the hydraulic metaphor would predict when an inflow exceeds an outflow.

[4] Keynesians, including Keynes himself, were not the first to emphasize the negative aspects of saving. To the Mercantilists saving, according to Heckscher, "was regarded as the cause of unemployment, and for two reasons: in the first place, because real income was believed to diminish by the amount of money which did not enter into exchange, and secondly, because saving was believed to withdraw money from circulation." For more detail, see Heckscher, page 208. Further, Schumpeter wrote that saving was a "public enemy" to the Physiocrats in general because it reduced both the bon prix and net product and, for Quesnay in particular, because it disrupted the flow of purchasing power in the Tableau Economique. See Schumpeter, page 287. Other prominent anti-savers before the Keynesians included Mandeville, Malthus and Lauderdale.

[5]The equality of saving and the demand for bonds, of course, would be challenged or denied by Keynes since he stressed the store of value function for money and claimed that economic agents could hold speculative or idle money balances. In essence, Keynes extended the notion of saving beyond the Classical realm to include both the purchase of bonds and the holding of idle, non-interest bearing cash as a store of value. Therefore, in the Keynesian view, the amount of saving flowing through the bond market as the demand for bonds can be less than total current saving.

capital and they only issue bonds for the purpose of financing the purchase of capital goods. Investment (I) is then equal to the supply of bonds S^B with the quantity of bonds supplied being a positive function of the price of bonds. These assumptions and the previously described functional relationships give rise to the simple bond market diagram shown in Figure 1 which anchors the analysis of this paper.

Figure 1



As in the standard Keynesian analysis, equilibrium occurs where leakages and injections are equal, in Figure 1 at P^B_E.

Now suppose that aggregate saving exceeds investment. From the Keynesian point of view and the familiar Keynesian cross diagram, this excess of leakages over injections in the real economy would necessarily occur at a level of real gross domestic product greater than the equilibrium level and the aggregate surplus of goods and services--the accumulation of inventories--would thereby cause real GDP to decrease, ultimately to its equilibrium level. From the Classical perspective, however, the same flow disequilibrium manifests in the bond market at some price below the equilibrium price of bonds, such as P^B_1. The resulting shortage of bonds and the excess of injections over leakages in the bond market would cause bond prices to rise until equilibrium is restored. A symmetric but opposite result obtains if investment in the economy is greater than saving. While Keynesians would interpret this situation as an excess of injections leading to an increase of real GDP, the Classical school would view this disequilibrium as an excess of leakages which would imply a temporary price of bonds above equilibrium. Hence, the surplus of bonds and excess of leakages would cause bond prices to decrease.

Compared to Keynesians, the Classical approach to leakages and injections would focus on the bond market and bond prices rather than the commodity market and flow of real gross domestic product. Hence, these competing schools interpret the flows of saving and investment differently and reach different conclusions with respect to the directional disequilibrium adjustments in these markets. As these generalized assertions are made in the context of a simple two-sector economy, we now examine the robustness of these claims by extending the model to include first government spending and taxation and then exports and imports.

Adding the Government Sector

We begin our inclusion of the government sector with an examination of a budget surplus. Keynesian macroeconomics posits that a surplus of total tax revenue in excess of total spending by government constitutes a net leakage from the spending stream and consequently decreases equilibrium real gross domestic product. The analysis of the Classical analogy to this, however, reveals that the resulting bond market outcome would be quite different. From this perspective, a government budget surplus, or positive public saving, would constitute a net injection into the bond market which leads to an increase in the equilibrium price of bonds. Given this, there are two scenarios that logically follow. First, suppose that government uses the surplus to retire some or all of its existing debt. In this case, the supply of bonds in the capital market would decrease and the equilibrium price of bonds would increase. Second, and rather than

retiring some of its existing debt, government could acquire either new or existing debt of other economic agents. Acting upon this decision would lead to an increase in the demand for bonds and, as with debt retirement, an increase in the equilibrium price of bonds. Therefore, and regardless of which strategy is adopted by government, the Classical method of analyzing a government budget surplus is symmetric to but market-distinct from the standard Keynesian analysis and conclusion of such flows.

Now suppose that government spending is greater than tax revenue. Keynesians interpret this budget deficit as a net injection to the spending stream which increases equilibrium real gross domestic product. The approach embraced by the Classical school and its conclusion is again quite different. To finance the resulting budget deficit, government must borrow by selling bonds in the capital market.[6] This borrowing manifests in an increase in the supply of bonds and constitutes an increase in the net leakage of funds from the bond market, leading to a decrease in the equilibrium price of bonds. Again, the Classical analysis and bond market result directly mirrors the traditional Keynesian view in the goods market.

Adding the International Sector

We now conclude our analysis by extending the previous three sector closed economy model to include a foreign sector. Suppose first that the economy under consideration is experiencing a balance of trade deficit. To the Keynesian school, the trade deficit is viewed as a net leakage from the stream of aggregate expenditures and induces a decrease in the equilibrium level of real gross domestic product. Once again, we emphasize that both the orientation and the outcome of the Classical treatment of this scenario are methodologically and analytically quite different. The standard Classical school treatment of this would interpret the balance of trade deficit as an increase of foreign saving in the home country. The resulting increase in the demand for bonds by our trading partners and the concomitant net injection of dollars into the domestic bond market causes the expected increase in the price of bonds. On the other hand a balance of trade surplus, which is a Keynesian net injection to the commodity market that increases real gross domestic product, is viewed by the Classical school as a net leakage from the bond market, causing a decrease in the equilibrium price of bonds. As with the two previous environments, one taking place in the simple economy and the other extended to include government spending and taxation, the Classical interpretation and outcome of a disequilibrium with the leakages and injections analysis including an international sector is quite distinct from but directly mirrors the Keynesian method.

Summary and Conclusion

The Keynesian analysis of leakages and injections, which focuses on the commodity market and the determination of real gross domestic product, has been an important part of macroeconomic pedagogy for now more than six decades. This paper offers an alternative interpretation of macroeconomic hydraulics that is based on the Classical school and centered on the flows of dollars in the bond market which determine the price of bonds. From this, two conclusions arise. First, the Classical perceptions of the various macroeconomic flows can be viewed diametrically in contrast to the Keynesian point of view. For example, while the Keynesians view saving as a leakage from the real economy or spending stream, the Classical school might interpret and define saving, alternatively, as an injection into the bond market. Second, and arising directly from the differing perspective of the macroeconomic flows, the Classical school reaches analogous results for the determined variable compared to the Keynesians. Whereas Keynesians have historically taught that government budget deficits represent a net injection to the real economy which increase real gross domestic product, the Classical school on the other hand would define these deficits as a net leakage from the bond market decreasing bond prices. Perhaps this exposition of the Classical reconsideration of macroeconomic hydraulics will prove to be beneficial to students.

[6] This assumes no monetization of the deficit.

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