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A Segmented Markets Model to Teach Analysis of Monetary Policy Shocks in Developing Economies

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Abstract:

The standard undergraduate textbook models in macroeconomics like the IS-LM/AD-AS model are not disaggregated enough to understand the effects of monetary policy shocks in developing economies typically characterized by substantial informality, and goods and financial markets segmentation. In this paper, I present a version of a segmented markets model based on Williamson (2009, 2011) that could be used as an effective alternative. I demonstrate the use of the framework by analyzing the effects of demonetization- a substantial reduction in the availability of outside money- in a developing country setting.

Keywords: segmented markets, developing countries, demonetization, economic education, informal markets, undergraduate macroeconomics.

JEL Codes: A22, E42, O17

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I. Introduction

On November 8, 2017, the Prime Minister of India declared 85% of the total Indian currency in circulation as void for transactions- a policy shock termed as demonetization. Several analytical and opinion pieces were published in Indian and international media arguing for and against this policy. Most of these include data and evidence based arguments but very few provided a theoretical framework to understand the effect of such drastic reduction in the quantity of outside money in a developing economy such as India. In this article, I present one such framework. It is a variant of the segmented markets model illustrated by (Ch.12, Williamson (2011)). The exposition is based on my article on the effects of demonetization specifically considering the structure and features of Indian economy (Waknis, 2017). Here, I demonstrate its use to analyze the effects of demonetization in developing economies.

This article contributes to the literature on undergraduate teaching of macroeconomics and monetary economics in two ways. One, unlike the traditional textbook experiments of changes in the money supply, or its growth rate, this article looks at the experiment of demonetization- total or significant reduction in the available stock of outside money to settle payments and debt. Secondly, it provides a simple graphical framework that can be used in an intermediate macroeconomics course with a focus on developing economies to teach monetary policy analysis.

While changes in money growth rates or levels are important and necessary experiments to be covered, it is also important to include experiments focused on emerging economies to broaden the understanding of macroeconomic policies for a typical economics major or minor. Such an addition should also increase the appeal of these textbooks to the educational institutes in emerging economies that often face dearth of educational material relevant to the economic and policy environment characterizing these economies. This article also contributes to the efforts of bringing macroeconomic models from research articles about emerging countries to undergraduate teaching. For example, Duncan (2015) presents an undergraduate version of the model in Aguiar & Gopinath (2007) to facilitate teaching business cycles for emerging economies.

The model used here is in the micro-foundations style pioneered by Barro (1997) and continued by Williamson (2011, 2018). I use the segmented markets model from Williamson (2011) and add some elements from Williamson (2009) to capture the substantial presence of informal sector in developing economies along with goods and financial markets segmentation.

II. A modified Segmented Markets Model:

In any economy there are some consumers and firms that trade in formal financial markets and use electronic payments system to settle debt and payments. Other set of firms and consumers use cash to settle debt and depend primarily on informal credit. In developing countries such as India, the set of consumers and firms that deal in cash only is relatively substantial in size than in developed countries. According to World Bank (2014), only 53% of the Indian population 15 years or older have a bank account indicating limited financial inclusion. The firms in informal sector that depend on cash for sales and credit employ substantial portion of the labor force. Therefore, to understand the effects of monetary policy changes in a developing economy we need to consider this substantial degree of financial market segmentation. The segmented markets model is a flexible prices and wages model but still displays monetary non-neutralities for short run. It is a micro-founded model where agents in the economy base their decisions on constrained optimization (Williamson 2011)². The decisions and assumptions are as follows:

1. Consumers optimize on two dimensions:
 - a. Current consumption and Leisure given the wage rate and goods prices. This gives rise to the standard upward sloping labor supply curve (N^S)
 - b. Current and future consumption given the real interest rate, r . This gives rise to savings curve in market for financial capital and changes in the real interest rate effect ($N^S(r)$)

² The segmented markets approach is due to Grossman & Weiss (1983), Lucas (1990), Rotemberg (1984), and Fuerst (1992).

2. Firms optimize to choose two variables:
 - a. Current demand for labor taking wages as given. This gives rise to labor demand curve (N^d) for a given capital stock and total factor productivity.
 - b. Current demand for capital given the interest rate and its marginal productivity.
3. Output demand (Y^d) comes from equilibrium demand for current consumption and investment goods and government expenditure and is affected by changes in real interest rate through consumption and investment expenditure.
4. Output supply (Y^s) is determined by total employment for a given real interest rate and the production function.
5. Money demand (M^d) is a function of price level and output. Money supply (M^s) is fixed by the central bank.
6. Government balances the budget.
7. Competitive Equilibrium: All markets clear.

To represent goods and financial markets segmentation as well as the presence of informal sector in developing economies, following Williamson (2009), I assume there are two sets of firms and consumers in the economy³.

1. Connected consumers and firms: The set of connected firms and consumers have access to the formal financial markets and settle payments and debt through electronic transfers. This set represents firms and workers in the organized formal sector in developing countries.
2. Unconnected consumers and firms: This set of firms and consumers do not transact through formal credit markets or use electronic payment systems and settle their payments and debt through cash. This group represents firms and workers from the unorganized or informal sector.

For the benchmark case, I assume there is no spillover between the connected and unconnected economic agents. Thus, in addition to financial market segmentation there is also perfect goods market segmentation- i.e. connected households purchase goods and services from connected firms and unconnected consumers do so from unconnected firms. Given this, I use two different diagrams to represent the connected and unconnected sets of consumers and firms. This allows us to show the impact on these two parts of the economy separately improving the ability to track the differential impact and responses of the two sets of consumers and firms.

Another feature of the developing economies that warrants modification of the segmented markets framework in Williamson (2011), is the significant difference in productivity of

³ The terminology of “connected” and “unconnected” consumers is from Williamson (2009).

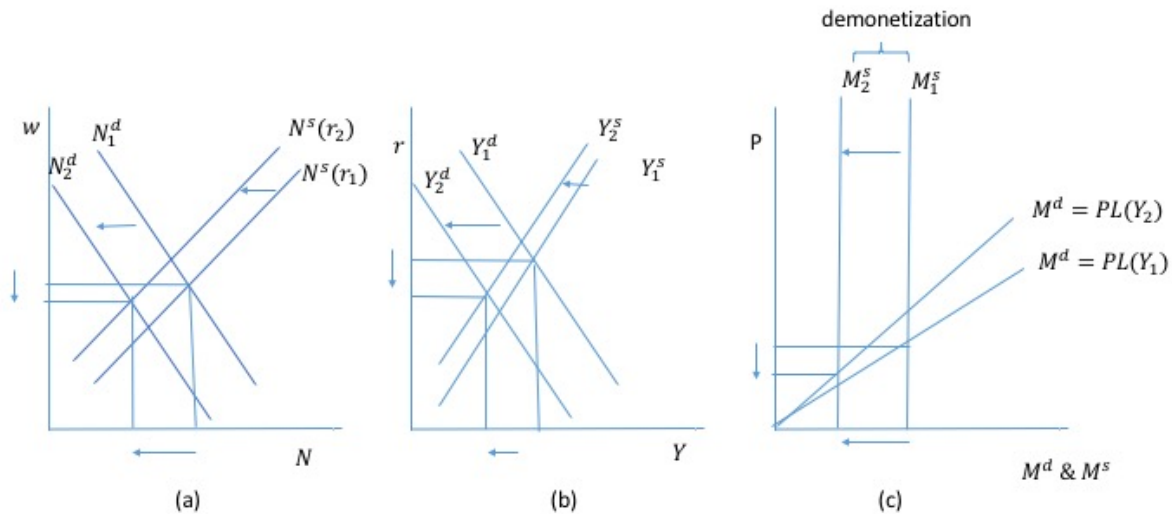
informal and formal sectors, with the former being significantly less productive than the latter. This is evident from the fact that the informal sector employs more than half of the labor force and contributes much less than that to the GDP. To reflect these differences, I show the output supply curve steeper for the unconnected sector than the one for connected sector. This implies that a given increase in real interest produces a larger increase in output in the formal or connected sector than in the informal or unconnected sector.

III. A Policy Experiment:

Demonetization means decrease in money supply not associated with open market operations by the central bank. Several developing countries have gone through multiple episodes of demonetization with the most recent one being in India announced on November 8, 2017. What would be the effect of demonetization in such a setting that closely represents the structure of a developing economy?

The following graph demonstrates the effect of such a policy on the unconnected households and firms. Assume that the economy is in equilibrium to start with. The following diagram shows the effect.

Demonetization in Segmented Markets Model: Unconnected Firms and Consumers



Panel (a) shows the labor market, (b) the goods and services market and (c) the money market.

The following steps outline the effect of demonetization.

1. Demonetization leads to a reduction in money supply in the economy caused primarily by decline in the money in circulation. The money supply curve shifts left, $M_2^s \leftarrow M_1^s$, in panel (c).
2. As the unconnected consumers and firms have less cash now, output demand will go down, $Y_2^s \leftarrow Y_1^s$. This is because consumption falls and any investment plans are stalled. Note that this shift could be dampened or delayed by credit arrangements that consumers have for example, credit with the neighborhood grocery stores.
3. The left shift in the output demand curve, Y^s , leads to a reduction in the real interest rate r . In panel (a), this affects the labor supply curve. Reduction in real interest rate reduces the opportunity cost of current labor or simply put people have to skip work to stand in

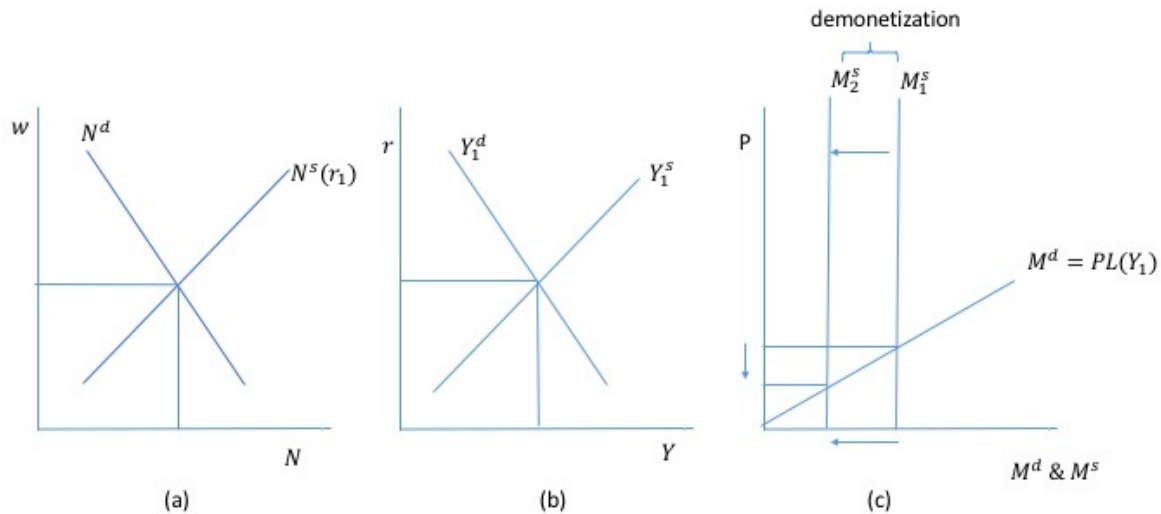
line to change currency notes. This leads to a left shift in labor supply curve $N^s(r_2) \leftarrow N^s(r_1)$.

4. The second effect is on the labor demand side. The unconnected firms do not have enough cash to pay wages and therefore they reduce their labor demand or shut down shifting the labor demand curve to the left, $N_2^d \leftarrow N_1^d$.

In all, employment declines and output supply curve also moves to the left reinforcing the decline caused by falling aggregate demand. Because output falls, eventually there will be a decline in the demand for money arresting some decline in aggregate price level caused by demonetization. To summarize the unconnected economy experiences a significant decline in employment, output, real interest rate and aggregate price level.

What about the connected economy? The following graph shows the effect on the connected consumers and firms.

Demonetization in Segmented Markets Model: Connected Firms and Consumers



As you can see in the diagram for the connected consumers and firms, not much happens. Demonetization shows up as decline in money supply but this decline is primarily in cash. These consumers and firms have access to electronic payment systems and credit markets which allows them to ride the shortage of cash with minor inconveniences. They also experience decline in price level and there could be an increase in output demand. As there is no change in real interest rate or because organized firms do not have any issues paying wages- wages and salaries get credited to employee bank accounts- there is not much change in the formal labor market either.

The total effect of this monetary policy shock to the economy would depend on the following factors:

1. Relative contribution to the GDP of the connected and unconnected sectors: As has been shown and argued by literature on informality (See LaPorta & Shleifer, 2008, 2014),

informal firms are significantly less productive than their formal counterparts. Therefore, the model suggests that the impact on output or real GDP might not be as dramatic as suggested by the diagram on unconnected firms. However, the human impact in terms of reduced consumption, employment and wages would be experienced by larger section of the population.

2. Possibility of survival for unconnected firms: Some of the firms in unconnected or informal sector that shut down may not revive after money supply with new currency is restored (Shah 2016). In this case some loss of output may persist longer till the slack is picked up by the connected sector.
3. Interdependence of connected and unconnected sectors: In many developing countries, many raw material suppliers to the formal connected firms come from the informal sector. If they suffer because of drained out cash, it would affect output supply of the connected firms as well reducing supply of goods and services in the overall economy. Some of this effect could be permanent as not all the firms that shut down would be revived. Secondly, connected firms might depend on informal labor markets to keep the cost of production down (Castillo & Montero 2010). Therefore, in addition to loss of output, there may also be increase in cost of production as the reliance of these firms on formal labor markets goes up.
4. Imperfect goods market segmentation: Goods market segmentation may not be perfect in many developing countries. Some of the output from the informal sector (agricultural produce, textiles, and some fast moving consumer goods) is consumed by the connected consumers as well. If they cannot buy these goods and services because of temporary shortage in cash, there will be some fall in their consumption demand.

5. Dependence on informal credit markets: Both formal and informal firms depend on informal credit markets to finance their short term expenditure⁴. Typically, such lending is primarily cash based and therefore demonetization will have adverse impact on the day to day running of formal firms as well.

Note that a severe adverse monetary policy shock like demonetization might affect the stock of unaccounted cash but would not affect future flows of such cash. Demonetization, in itself, may not dissipate the fundamental factors giving rise to such flows. The future flows of unaccounted cash would depend on factors like complexity of tax system, labor market regulations, and trust in the ability of the government to provide public goods among others.⁵

IV. Concluding comments

This paper demonstrates the use of a segmented markets model to analyze effects of total or significant reduction in the availability of outside money. Such policy is termed as demonetization. India would be the latest in the list of developing countries to resort to it. The model shows that a policy of demonetization would cause significant damage to the unconnected households and firms leading to reduction in the unconnected sector's output, employment, consumption and the real interest rate (discount factor). On the other hand, the connected households and firms experience only a temporary reduction in consumption as they can continue transacting using electronic payments and ensuring sufficient real balances by trading on the financial markets. Given that in most developing countries, the informal sector constituted

⁴ The dependence of formal sector firms on informal sector financial sources is a well-documented fact. For example, see Allen, Qian, & Qian (2005) and Allen et al (2012) for stylized facts about firm financing patterns in China and India respectively.

⁵ See Enste & Scheider (2000) and LaPorta & Schleifer (2014) on causes and determinants of informality.

by unconnected households and firms employs most of the economy's labor force but contributes between one fourth to one third of total GDP, the impact of demonetization may not show up that pronounced in the data. However, a significant reduction in consumption and overall deprivation would be experienced by substantial portion of population. There might be some impact on connected sector's output, cost of production, and employment depending on the extent of its dependence on informal labor and credit markets.

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