

Market Dynamics: Measuring Impact of Economic Events and Government Programs on Production and Employment

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¹ Market Dynamix

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Abstract

The impact of austerity, fiscal and monetary programs has been a subject of numerous studies and findings regarding the effectiveness of such government policies in combating economic downturns by stimulating growth, increasing employment, and promoting investment. The recently introduced Market Dynamics method has been extended to provide a dynamic Production model that incorporates employment, wages, consumption, investment, government spending, interest rate, taxes, and other related factors. The model is used to compare the impact of austerity, fiscal and monetary programs in response to an economic downturn and to measure the size and effectiveness of government actions including changes in spending, taxation and interest rates. A conservation of commerce principal is defined stating that money flow from wages, spending, borrowing and interest activities must match the change in production trades. The latter mechanism is responsible for a lag in response as the full impact of an event is gradually realized over its time horizon.

Index terms— market, dynamics, production, commerce, employment, wages, government, spending, consumption, investment, austerity, fiscal, monetary, growth.

1 INTRODUCTION

Several models are widely used to measure the impact of economic events and government responses on production and employment with varying strengths and weaknesses. These include largescale macroeconomic, vector autoregression (VAR), and dynamic stochastic general equilibrium (DSGE) (Auerbach 2012). Macroeconomic based methods are often difficult to construct and compare since observed data does not point to a single preferred policy (Wielan 2012). In contrast, VAR models utilize systems with multiple variables each defined by its own lagged response values as well as those of other remaining variables. Using an impulse-response approach, future expected values of these variables are calculated in response to a unit increase in a single variable ??Sims Author: Market Dynamix. e-mail: jdayanim@mdynamix.com 1980). Lastly, DSGE models rely on empirical data to calibrate the values of structural components such as demand, supply and government policy, and apply a synthetic series of shocks in order to calculate the corresponding moments and then compare to observed data. The latter also utilizes an impulse-response approach along with stochastic methods in order to calculate the expected outcomes (Ruge-Murcia 2007; Sbordone 2010). These models can vary based on assumptions related to price flexibility and simulated behavior of their structural components.

It seems a more foundational model that incorporates various factors of production and their interactions would be beneficial. Such approach would present a more consistent view of the economy and provide new insight into the relationships between employment, wages, consumption, spending, investment, and other production factors.

The presented extension to Market Dynamics (Dayanim 2011(Dayanim , 2016)) provides a differential approach to measuring the impact of economic events and government responses on production output. The formulation introduces a production equation, defines a conservation of commerce principal, and uses an event driven approach to measuring the impact of economic activities. Starting with a basic production equation, the

model is enhanced in successive steps to take into account the various factors affecting production. An event time horizon as well as several dynamic indicators are presented that assist in measuring the progress towards the expected change in production. A superposition method is introduced that provides for the addition and measurement of the cumulative impact from multiple consecutive events with overlapping time horizons.

The model is applied to a comparative analysis and measurement of possible government responses to an economic downturn event in the form of austerity, fiscal and monetary programs. These programs are based on several prevalent theories regarding the impact of government actions on the economy. Historically, the Keynesians argue that government can fuel growth by borrowing money and returning it into the economy through various spending programs (Keynes 1936). On the other hand, "Deficit Hawks" believe that budget deficits are at fault as they lead to higher interest rates which in turn results in lower investment. Hence, Austerity in the form of increased taxation and reduction in government spending is viewed as the primary means for resolving and averting crisis (Crotty 2011). Finally, Monetary policy aims to promote employment, stable prices, and moderate long term interest rates through actions by the central bank including purchase and sale of government securities, adjustments to the short term discount rate, and changes in bank reserve requirements (Board of Governors of the Federal Reserve System 2016).

The model is used to measure the size of austerity, fiscal and monetary programs in the form of changes in government spending, taxation and interest rate required to restore production and employment to pre-economic downturn levels. Using current economic data, the model is further applied to the analysis of observed slow down in production and money flow growth. By determining the sources of economic slow down several potential courses of action are identified.

2 II.

3 DYNAMICS OF PRODUCTION a) The Production Equation

The production level for a simplistic isolated economy consisting of individual workers, buyers, and sellers who freely exchange goods and services can be stated as: $Y_n = C_n + I_n$ (1)

where Y_n represents the production level in a specific time period n , C_n the value of consumable goods traded during the same period, and I_n the value of traded investments. C_n is also a measure of purchasing power or in this case earned wages and can be measured by multiplying the number of gainfully employed labor force L_n by the average prevalent wage to obtain total wages in the economy, that is: $C_n = W_n L_n$ (2)

with employment level in turn measured as the ratio of employed labor force over the total available labor force seeking employment L_n , or: $L_n = \frac{N_n}{N_n + U_n}$ (3)

In this context, consumables are goods and services that are used by individuals and provide little residual value past their expected life such as food and cars, while investments represent accumulated capital such as inventory, equipment and buildings. Note that the generation of consumed goods and investments may have occurred during any past or present period, and what is relevant is when the value is realized through a trade activity. Hence, any goods or services that are not traded due to lack of interest or inactivity are ignored until discarded or sold in a later period. The value of consumables is determined using a value added approach by measuring the sum of all trades or purchases p during the period less the cost of any raw material, equipment or services (excluding wages) used in production m , that is: $C_n = \sum (p_{ni} - m_{ni})$ (4)

Similarly, investment value or accumulated capital is measured as the sum of individual transactions by adding the difference between the buyer's purchase value and the seller's cost basis for each transaction less the cost of any improvements, that is: $I_n = \sum (p_{ni} - p_{ni-1})$ (5)

where p_{ni} is the sale price and p_{ni-1} the original purchase price. In this manner, equation (1) states that in a simple isolated economy earned wages are fully utilized to purchase consumable goods or invest in capital assets. Combining equation (1) and (2) results in: $Y_n = W_n L_n = C_n + I_n$ (6)

i. Government Spending Basic sources of government spending include taxes T collected from earned wages and loans L obtained from participants in the economy who are willing to lend funds in return for repayments R over an extended period of time at a set interest rate. The government spending can be viewed as additional production capacity that is added to the economy while wage taxes represent a corresponding reduction, that is: $Y_n = W_n L_n + G_n = C_n + I_n$ (7)

where wage tax is measured as a product of earned wages and the weighted average tax rate: $T_n = W_n L_n a$ (8)

and government spending consists of several components: $G_n = T_n + GL_n + GR_n$ (9)

where the tax spending coefficient a represents the portion of wage taxes spent back in the economy, GL_n the level of government borrowing in the current period, and GR_n the accumulated loan repayment amount for the period. It is reasonable to set $a = 1$ where there is new government borrowing in the period so that all taxes are spent prior to borrowing additional funds. However, the value of a may be less than 1 if taxes are used to pay down loans and lower the repayment amount on past borrowing activities. Government spending in the economy effectively transforms into worker wages hired to perform government sponsored initiatives.

4 ii. Exports and Imports

In the presence of other foreign economies, goods and services may be traded across national boundaries. To account for this, consumables can be viewed to consist of domestically produced goods and services consumed within the local economy CD , as well as two new elements related to the consumption of exports CX and imports CM : (10) with the latter stating that production level increases with growing exports and decreases with a rise in imports. Equations (7) and (10) when taken together somewhat resemble the familiar aggregate demand equation: $Y = C + I + G + X - M$ (11)

where X and M indicate exports and imports (Wikipedia 2016).

iii. Foreign Investment Similarly, participants in foreign economies may invest in the local economy and the investment component is adjusted to account for foreign investment activities, that is: $Y = C + I + G + X - M + F$ (12)

with ID representing domestic investment by local investors. The level of investment in the local economy increases as foreigners invest in the system IM and is lowered as local funds flow outside the system IX . iv. Personal Savings and Borrowing Savings represents excess earned wages lent by participants in the economy to investors in return for received interest income. In this manner, savings lowers the production impact of wages but in turn results in an increase in investment activity as more funds are available for borrowing. Participants in the labor force can also borrow money for investment and pay back over time with interest. The net effect of personal savings and borrowing is as follows: $Y = C + I + G + X - M + F + S - B$ (13)

where S and B represent personal savings and borrowing, and FS and FB representing personal savings and earned interest. The amount of earned interest depends on the prevailing rate of interest for savings r_s , that is: $FS = S \cdot r_s$ (14)

with FL and FR representing personal borrowing and loan repayment, and FS and FN representing personal savings and earned interest. The amount of earned interest depends on the prevailing rate of interest for savings r_s , that is: $FN = B \cdot r_s$ (15)

and similarly the repayment on a personal loan is based on the prevailing loan interest rate r_l : $FR = B \cdot r_l$ (16)

v. Inflation Inflation may be viewed as an increase in the price of consumable goods and services. Equation (7) can be stated using prices from the prior period in order to account for the current period's inflation, as follows: $Y_t = (1 + \pi) Y_{t-1}$ (17) where π is the inflation rate. (18)

where a weighted average inflation rate is used to measure consumption amount at the end of the period using prior period prices. If similar quantities of good and services were purchased in both periods, the above can be restated as: $Y_t = (1 + \pi) Y_{t-1}$ (19)

However, inflation can have a negative impact on consumption due to higher prices unless accompanied by a similar increase in wages.

vi. Economic Growth Economic growth may be a result of an increase in employment or population, a rise in wages or labor productivity, elevated domestic consumption or investment, additional foreign interest in domestic products, or similar factors. This can be stated as: $Y_t = (1 + g) Y_{t-1}$ (20)

where g is the average rate of growth. A moderate economic growth is considered beneficial as it encourages higher average wages and employment, lower government borrowing, and increased investment.

5 vii. Behavioral Factors

Changes to the production level can be attributed to individual events, some tangible such as a change in personal lending rate or additional government spending with others more behavioral such as loss of consumer or investor confidence. The impact of behavioral elements is reflected as changes to the values of C and I . For example, the trading value of an investment such as a security or rental property may be stated as the product of its current earnings IE and price to earnings multiplier IPE , that is: $I = IE \cdot IPE$ (21)

where the value of IPE incorporates the behavioral aspect of investors (Dayanim 2011(Dayanim, 2016)). The value of IPE can be measured historically, for example using a 30 day average for recent transactions, or estimated using other behavioral based models. By applying a partial derivative to an investment the impact of a change in the multiplier on the investment value can be determined using: $\frac{\partial I}{\partial IPE} = IE$ (22)

The overall number of transactions may also be affected due to a drop in investor demand as uncertainty in the economy rises. A similar approach can be applied to Consumables component of production using equation (7) where transaction price

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Volume XVII Issue I Version I Year () and quantity incorporate the relevant consumer behavior. For example, a demand and supply based model can be used to estimate the change in consumable trades in the aftermath of an event.

7 viii. Other Production Factors

Local wage or sales tax, currency exchange rates, depreciation of goods and similar production factors can be introduced into the formulation by adjusting the corresponding component in the Production equation. For

example for a wage and consumption sales tax imposed by a locality new terms can be added to equation (13) as follows: $W = W + G + F + LT + LG$ (23)

where 6) represents a conservation principal stating that money flow from various sources such as wages, government borrowing and interest earnings equals the added value in traded consumables and investments., that is: $LTMF = P = (C + I) = C + I$ (26)

where P represents the change in production capacity in time period n or simply P and MF the money flow. In this manner contributions from successive periods can be added in order to measure the aggregate commerce over time: $MF = P + I$ (27)

where C and I represent the total trade in consumables and investments during the observation time period starting from an initial equilibrium point. The full impact of an economic event is realized over an event's Time Horizon as money flow from various trade activities accumulates to fully account for the anticipated change in production.

8 c) Dynamic Indicators

Several movement indicators are defined that provide for the measurement of progress towards a target production level for an event. As an event's time horizon nears, the accumulated money flow from trading activities fully supports the anticipated change in production and a new stable production level is formed. An event's Support Level may be measured by dividing the accumulated money flow from trades at time t by the anticipated change in production: $ESL = MF / P$ (28)

where $P = P_0$ with P_0 representing production level at the event's onset. The target production level P is measured using equation (7) after adjusting for changes in the various production factors. The event's Time Horizon can be estimated using: $ETH = ESL$ (29)

assuming a linear progression in time. The support level reaches 1 once the event's time horizon is reached. The expected production level P incorporates changes attributed to the accumulated money flow at time t and is estimated using: $P = P_0 + P \cdot ESL$ (30)

A divergence indicator is defined to measure the difference between the target and current observed production levels: $EE = P - P_0$ (31)

while a similar expectance indicator measures the difference between the expected and current observed production levels: $EE = P - P_0$ (32)

9 d) Superposition of Events

Using the presented dynamic model, the aggregate impact of events such as economic shifts and government actions on the production level can be measured by superposing multiple events and adding their individual impact on production. This is possible since the formulation in equation (6) presents a linear system. This process is particularly important as the full impact of an event often lags behind its initial onset. The effect on the economy and production is seldom immediate since it requires time for participants and governments to digest and analyze an event, adjust their consumption level, borrow funds, find investment opportunities, or lower tax rate and interest on loans. An event Time Horizon can be defined representing the elapsed time from the onset of an event until its impact is fully realized. In this manner, one often observes the aggregate impact of multiple events with overlapping time horizons when measuring various economic indicators.

To demonstrate this, Table ?? lists the federal reserve monetary policy actions from 2006 through 2015. This data is used along with first mortgage originations in Table ?? to estimate the change in borrowing level and repayment amounts and calculate the impact on money flow and production for this one the initial factor. To do so, the expected ΔFR , that is the anticipated change in consumer debt repayment for each federal funds rate change event is measured by considering that the total outstanding mortgage debt as of the event's onset will be refinanced over time at the lower rate. To demonstrate the point a quick estimation of the expected change in repayments is made by multiplying the total mortgage debt by the rate change as though the debt consists of equity line mortgages. Alternative estimation methods can prove more accurate by using the average mortgage balance, financing rate, remaining term and monthly payments. Finally, the expected loan repayment also includes adjustments related to shifts in the aggregate borrowing level FL which is measured using a product of the incremental change in borrowing and the current interest rate.

As the impact of a rate change is realized gradually over time the event's time horizon can be estimated by dividing the number of outstanding mortgages by the mortgage origination volume for the quarter. For example for the 2008Q1 rate change event, the estimated time horizon is 25.4 quarters or 6.3 years. The event's incremental ΔFR contribution for each pursuing quarter can also be estimated by multiplying the total expected change in debt repayment at the event's onset by the ratio of quarterly mortgage originations to the total outstanding mortgages in 2008Q1. This iterative process ends once the aggregate quarterly mortgage originations reaches the total outstanding mortgages at the event's onset indicating a full portfolio turn-over. The latter discussion assumes the average mortgage loan value remains relatively unchanged during the event's time horizon, but a more accurate treatment would utilize the aggregate mortgage values rather the counts. Table ?? details the impact over time for three successive rate change events starting with 2008Q1 and the results are displayed in

Figure 1. Each dotted or dashed line depicts the lagging behavior attributed to a specific event with the solid line showing the aggregate impact.

10 GOVERNMENT PROGRAMS a) Economic Downturn Scenario

Equipped with a dynamic model of production and its various factors, it is now possible to evaluate the impact of discrete events and analyze how a specific government response may affect the economy. Consider a scenario where an event results in a drop in demand and the right side of the production equation (1) suddenly shifts downward. Since the government is interested in avoiding an economic downturn, there is an interest in determining how to maintain the starting employment level and wages prior to the onset of the event. Three popular programs are analyzed include austerity, fiscal and monetary policies.

11 b) Austerity

Policy makers believe that the economy is overleveraged due to excess borrowing and the path to recovery is to pay down debt by raising taxes and cutting government spending on social programs. The policy objective is to maintain the starting employment level and wages despite a recent decline in the right side of the production equation, that is a drop in consumption and investment.

In this scenario, additional taxes need to be raised along with a cut in spending in order to push down the borrowing level. Using equations (7) and (9), assuming no additional borrowing during the period and by requiring the government to divert a portion of tax revenues to paying down accumulated debt, yields the following: $\Delta Y = \Delta Y_{\text{tax}} + \Delta Y_{\text{spend}}$. $\Delta Y_{\text{tax}} = \Delta Y_{\text{tax}} (1 - \alpha)$. $\Delta Y_{\text{spend}} = \Delta Y_{\text{spend}} + \Delta Y_{\text{tax}}$ (33)

For simplicity, assume that the borrowing rate remains unchanged at $r = 0$ over the covered time period. The total government loan debt at the beginning of the period is represented by GLT_0 and is lowered by the portion of taxes not spent back in the economy. The revised repayment amount can be calculated as: $\Delta Y_{\text{tax}} = \Delta Y_{\text{tax}} (1 - \alpha)$ (34) $\Delta Y_{\text{tax}} = \Delta Y_{\text{tax}} (1 - \alpha)$ (35)

and the required change in repayment amount in order to achieve wage and employment stability can be stated as: $\Delta Y_{\text{tax}} = \Delta Y_{\text{tax}} (1 - \alpha)$ (36)

The change in the production equation (33) due to downturn is measured using: $\Delta Y = \Delta Y_{\text{tax}} + \Delta Y_{\text{spend}} = 0 (1 - \alpha)$. $\Delta Y_{\text{tax}} = \Delta Y_{\text{tax}} (1 - \alpha)$ (37) $\Delta Y_{\text{tax}} = \Delta Y_{\text{tax}} (1 - \alpha)$ (38) $\Delta Y_{\text{tax}} = \Delta Y_{\text{tax}} (1 - \alpha)$ (39)

and the required incremental tax to achieve stable employment and wages is: $\Delta Y_{\text{tax}} = \Delta Y_{\text{tax}} (1 - \alpha)$ (40)

As an example, if production drops by 10% of wages, loan interest rate is at 4%, starting tax rate is 25%, and 65% of taxes are used to pay down debt, the additional austerity related tax can be calculated as: $\Delta Y_{\text{tax}} = 0.1 (1 - 0.35) (1 - 0.04) + 0.04 \cdot 0.25 = 0$ (41)

$\Delta Y_{\text{tax}} = 0.16 = 0 + 0.01 = 0.17$ (42) effectively requiring a 17% increase in tax rate to 42%. Government spending is also reduced from 25% of wages to 15% (35% of the new 42% tax rate) less any borrowed amount during the prior period.

12 i. Effects of Austerity

For an austerity program to restore the economic production to its prior level, it likely requires a substantial increase in wage taxes as well a material reduction in government spending. The size of the program is dependent upon the level of reduction in production capacity. The increase in wage tax rate can deter people from consuming or investing due to shrinking after-tax net wages, and the higher the increase the more severe the impact. This in turn places further pressure on the job market as employers become reluctant to hire due to a drop in consumption. Lowering government spending can further raise the cost of living due to lost entitlements and places at risk certain populations that rely on social benefits. However, a moderate tax rate adjustment coupled with a more judicious spending on social benefits can prove to be a valuable tool in lowering the national debt repayments, reducing risk of default on loans, and restoring economic health.

13 c) Fiscal Policy

Fiscal policy relies on additional government borrowing and spending in order to stimulate the economy and in this case maintain a neutral wage and employment level in response to an economic shock $\Delta Y > 0$; $\Delta Y = 0$; $\Delta Y = 1$;

(43) then the change in production can be restated as: $\Delta Y = \Delta Y_{\text{tax}} + \Delta Y_{\text{spend}}$ (44) where $\Delta Y_{\text{tax}} = \Delta Y_{\text{tax}} (1 - \alpha)$ (45) leading to $\Delta Y = \Delta Y_{\text{tax}} (1 - \alpha)$ (46)

and using $\Delta Y = \Delta Y_{\text{tax}} + \Delta Y_{\text{spend}}$ the incremental borrowing can be calculated as follows: $\Delta Y = \Delta Y_{\text{tax}} + \Delta Y_{\text{spend}} + \Delta Y_{\text{tax}} (1 - \alpha)$ (47) $\Delta Y = \Delta Y_{\text{tax}} + \Delta Y_{\text{spend}} + \Delta Y_{\text{tax}} (1 - \alpha)$ (48)

For the prior example, if production drops by 10% of wages, loan interest rate is at 4% and assuming no government borrowing for the prior period, in order to raise the production to its former level the additional fiscal policy related borrowing and the associated repayment cost can be calculated as: $\Delta GL = 0.1 \times 0.1 \times 0.04 = 0.004$ (49)

$$\Delta GR = (0.04) \times (0.004) = 0.00016 \quad (50)$$

indicating that a relatively modest increase in government loan repayments is required in response to the downturn.

14 i. Effects of Fiscal Policy

The increase in the size of government borrowing and loan repayments can lead to rising loan interest rates.

These rates are also subject to fluctuations in currency exchange rates if a foreign currency is used as the basis of received loans and repayments. An increase in the cost of borrowing can result in a spiralling down of the economy as investment slows down due to higher cost of financing and loss of investor confidence. However, provided a moderate national debt level and a nominal increase in loan interest rates fiscal policy can prove a powerful tool in combating an economic downturn. The impact of fiscal policy appears to diminish in the presence of prior period borrowing as indicated in Equation (48) due to the added contribution in the numerator which requires coverage through additional borrowing.

Fiscal policy at times is accompanied by a lowering of taxes on the premise that it increases net wages thus consumers feel they have more disposable income and apply it towards purchasing additional goods and services. Using equations (7) and (9) several assumptions are made related to an increase in borrowing, stable wage tax rate and employment, and fully spending wage taxes back into the economy, that is: goods and services.

However, as equation (32) indicates where wage taxes are fully returned to the economy through government spending the impact of lower taxes may be more psychological and without a lasting effect during a prolonged downturn. This outcome matches survey findings regarding the 2001 tax rebate stimulus impact (Shapiro 2013). However, such tax cuts may be directed at and benefit certain populations that are at greater risk such as lower income households.

15 d) Monetary Policy

Loan repayment are sensitive to interest rates set by the national regulator or Fed. By adjusting and lowering the personal loan interest rate the Fed can stimulate investment. Using equation (13) and (14) the change in production can be stated as: $\Delta P = \Delta FL + \Delta FR = \Delta C + \Delta I$ (51)

assuming there is no change to the rate of personal savings or government spending during the observation period. When personal loan rates drop investors can refinance existing debt at lower rates and borrow additional funds while maintaining the same repayment level FR_0 . The increase in personal borrowing is then used for additional investment in the economy. The impact can be calculated using equation (16) as follows: $\Delta P = \Delta FL + \Delta FR = \Delta C + \Delta I$ (52) $\Delta P = \Delta FL + \Delta FR = \Delta C + \Delta I$ (53) $\Delta P = \Delta FL + \Delta FR = \Delta C + \Delta I$ (54) $\Delta P = \Delta FL + \Delta FR = \Delta C + \Delta I$ (55) $\Delta P = \Delta FL + \Delta FR = \Delta C + \Delta I$ (56)

For the prior example, if production level is dropped by 10% of wages with personal loan rate of 6%, given that the prior period personal borrowing is at 20% of wages, the required change in personal interest rate to maintain a stable wage and employment level is: $\Delta P = \Delta FL + \Delta FR = \Delta C + \Delta I$ (57) $\Delta P = \Delta FL + \Delta FR = \Delta C + \Delta I$ (58) $\Delta P = \Delta FL + \Delta FR = \Delta C + \Delta I$ (59) $\Delta P = \Delta FL + \Delta FR = \Delta C + \Delta I$ (60) $\Delta P = \Delta FL + \Delta FR = \Delta C + \Delta I$ (61)

The loan interest rate must be lowered by 2% to reach the stated goal. The new personal loan level is: $FL = FL_0 + \Delta FL$ (62)

which has increased by the amount of drop in the prior period production level.

16 i. Effects of Monetary Policy

The drop in personal loan rate can result in increased borrowing and consequently a boost in production level provided investors are mainly considered with repayment costs.

However, the increased personal debt can pose a problem as loan rates return to normal levels over time resulting in higher repayment costs and an increasing number of defaults on personal debts. This negative impact can be mitigated through the use of fixed rate term loans as well as a more gradual renormalization of rates.

In reality, the effect of monetary policy may be somewhat smaller since aside from line of credit loans most term loans require repayment of a portion of the principle with each payment. For example, for a 30 year loan at 6% interest the annual payment for interest and principle is 7.2% of the initial loan amount payable in monthly installments, whereas at 4% interest the annual payment is 5.7% of the loan amount for a difference of only 1.5%. In order to reach the same level of increase in personal borrowing a larger interest rate drop is required. In the long run, borrowers can benefit from the principal repayment which lowers the loan amount and allows them to borrow additional funds through refinancing.

17 ECONOMIC GROWTH

Current economic growth can be estimated by incorporating changes in various production factors. The data is Table ??

The data indicates that the pace of growth in production or money flow is slowing down, specially when measured per employee as shown in Table ??. This is largely attributed to a slower growth in personal income and personal debt which are the largest two contributors to money flow. At the same time, the growth in consumption appears to be tapering down as well. As the trade deficit has remained relatively unchanged, the latter implies a slower rise in domestic production output.

In order to accelerate production growth, the money flow needs to increase. This can be achieved by additional government spending, a rise in domestic wages due to tighter labor markets or higher foreign labor costs, increased domestic investment by foreign nationals, or increased household borrowing. Specific actions may include new government spending on infrastructure projects, inclusion and enforcement of fair labor practices in trade deals, improvement in international economies leading to higher employment and wages overseas, incentives for investment in domestic plant and manufacturing, and further easing of consumer credit. At the same time, the expected rise in federal funds rate serves as a retardant force. Each possible action requires careful consideration in order to avoid negative side effects such as escalating national debt, trade wars, and household loan defaults.

V.

18 CONCLUSION

This study presents a dynamic model for the economy that takes into account various factors contributing to the production and trade of consumables and investments. Using a conservation of commerce principle, the formulation shows how flow of money from wages, spending, borrowing, and interest earnings fully accounts for observed trade activities. While economic events result in shifts in production capacity, the full impact of such events often lags behind and is materialized over an event's time horizon as trading activities continue. Once the accumulated commerce matches the observed change in economic production an equilibrium condition is reached representing a stable and fully supported production level.

Starting with a simple production model, the formulation is extended to incorporate key economic factors such as taxes, government spending, personal savings and borrowing, and provides for further extensions and analysis of specific areas of interest. This includes tangible as well as intangible behavioral elements that directly impact the level of consumption and investment in the economy. The latter remains an area that requires further investigation.

As multiple economic events may occur within an observation time period, a superposition method is introduced for adding the impact of individual events over their applicable event time horizons. In this manner, the approach provides for the study of production movements over extended periods of time. The dynamic model may also be used to forecast changes in production based on assumptions related to each contributing factor. Further work is needed in applying the model using historical data for key economic events and government actions and subsequently comparing the calculated outcomes against observed values.

The dynamic model is used to analyze the impact of austerity as well as fiscal and monetary policy during an economic downturn.

This relies on a methodical derivation using the introduced production equation and is presented in the form of a comparative study on how each policy can restore the economy to its prior production level. The presented approach can be used to analyze the effectiveness and impact of government policies on the economy as well as the associated risks. Using published data, the model is also used to review the current production capacity and money flow and identify potential sources for observed sluggish growth.

The presented dynamic method provides needed insight and understanding of the mechanisms responsible for changes to the production level. The classical approach enables access to a vast pool of existing scientific knowledge with potential application to the fields of finance, economy and commerce. The approach may be extended to any market with an orderly clearance of trade transactions, where intrinsic price values can be associated with the underlying traded commodities and goods. The valuations should follow a linear price equation that factors in the underlying market and human elements.

19 Date

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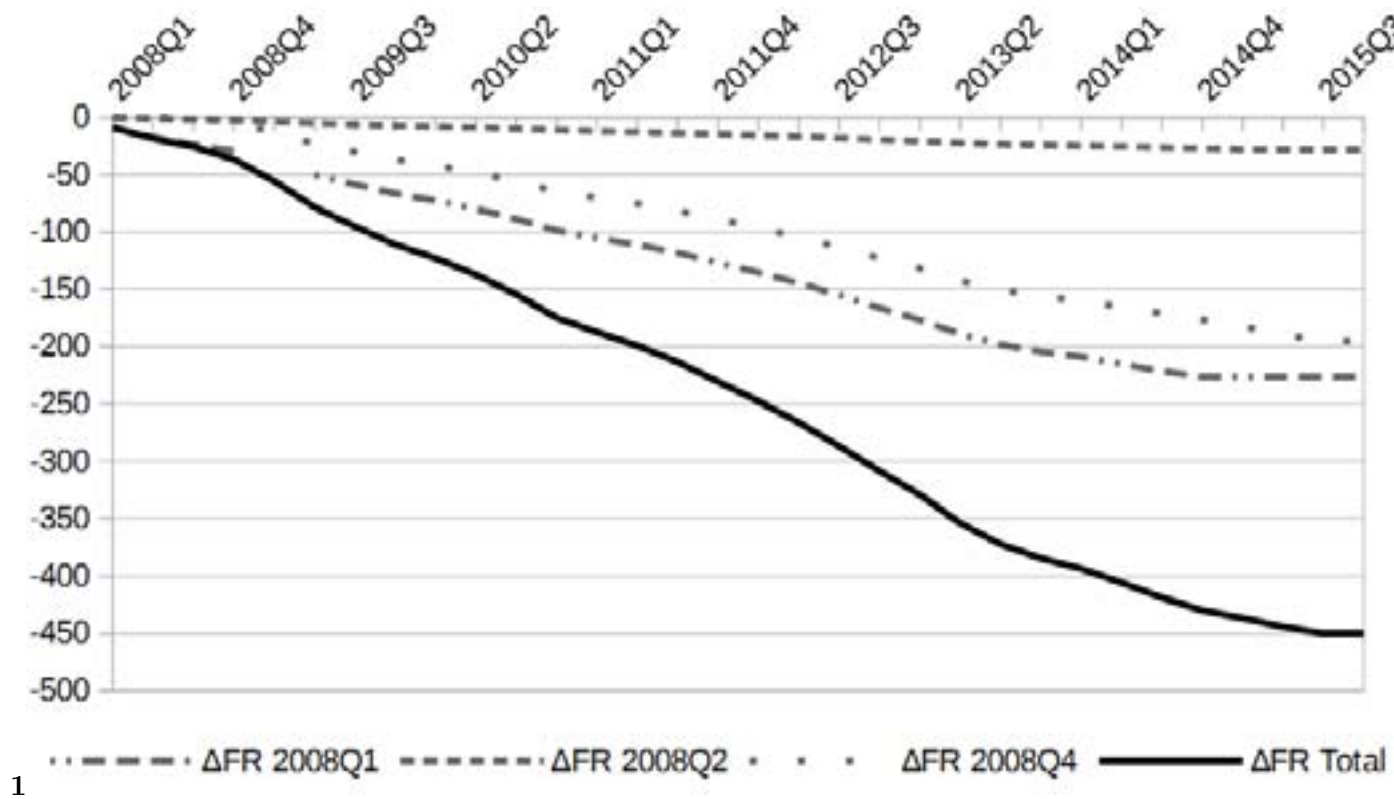


Figure 1: Fig. 1 :

[Note: ΔFR (24) using local wages LW , local consumption LC , as well as local wage and sales tax rates lt and lst . Also, $LG \Delta FR = la.LT \Delta FR + LGL \Delta FR - LGR \Delta FR$ (25) using a local tax spend coefficient la , local government borrowing LGL and loan repayment amount LGR . b) Conservation of Commerce Equation (]

Figure 2:

Figure 3:

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