Bob Tetlow

~~June 28 , 2023~~

July ~~17~~20, 2023

**More on MMB models that may or may not be calibrated**

**USVMPop** and **USVMPno** Verona, Fabio; Marnual M.F. Martins and Ines Drumond (2013) “(Un)anticipated Monetary Policy in a DSGE Model with a Shadow Banking System” *IJCB*(3): 73-117.

The papers looks at whether the Fed ran monetary policy “too low for too long” in the ‘00s using two versions of the Christiano, Motto and Rostagno (CMR, 2010) model, one with a BGG financial accelerator and the other without. The latter “corresponds closely” to Smets-Wouters (2003). They show that neither can easily produce boom-bust cycles, especially in the case of an unanticipated policy shock, and thus they propose an extension to shadow banking that with a “realistic calibration” based on the cyclical sensitivity of bond spreads for normal times (suffix: no) and times of over-optimism (suffix: op), can produce the boom-bust cycles of interest, especially for a low-interest rate policy that is unanticipated. Model calibration based on U.S. quarterly data, with shadow banking parameters that vary depending on the era. The bond spread gets particular attention. It is based on quarterly data from 1953 to 2011. They fit spread behavior to match the IRF from a VAR model that employs inflation, CBO output gap & FFR. The values of the parameter that are not new are based on the established NK literature. The own rule is an inertial Taylor-type rule written in forecast inflation, which is used as calibrated throughout. Subsection 3.2, is titled “Calibration,” and describes how most of the parameters are taken from CMR (sample period 1998:Q4 to 2003:Q4, or 1987:Q1 to 2003:Q4 depending on the parameter) , with a few others from Erceg, Henderson and Levin (2000) and some are “our calibration.” Bond finance calibration comes from De Fiore and Uhlig (2011) covering the period from 1999 to 2007; risky spread calibration is from Chen, Lesmond and Wei (2007) using data from 1995 to 2003, but this source just yields one number, the average spread between AAA bonds and Treasuries of 84 bps. They This is pretty clearly a U.S. model, but it is not estimated, except insofar as the bond spread could be described as estimated (not really). The variety of sources and date ranges underlying the calibration of this paper underscores how difficult it can sometimes be to specify “early estimation” or “late estimation” if one wanted to do so for a calibrated model.

**NK\_CLK09** Christoffel, Kuester and Linzert (2009) “The role of labor markets for euro area monetary policy” *European Economic Review*,53: 908-936.

Doesn’t the title say it all? This is a model of the EA economy with DMP search-and-matching technology for labor, Calvo arrivals of opportunities for families to bargain over wages, and partial indexation and right-to-manage bargaining. Bargaining power is potentially time varying. Inertial Taylor-type rule with both output gaps and growth, measured year over year. Some of the parameters are calibrated for EA data from 1984:Q1 to 2006:Q4. There is also an estimated version.

**NK\_GM05** Gali, Jordi, and Tommaso Monacelli (2005) “Monetary policy and exchange rate volatility in a small open economy” *Review of Economic Studies*,72: 707–734.

The paper lays out an SOE version of a Calvo sticky-price model to show that equilibrium price dynamics can be reduced to a simple linear relationship between *domestic* inflation and the output gap. They use the model to analyze the efficacy of policy rules that feedback on domestic inflation, a CPI-based Taylor-type rule and an exchange-rate peg. Welfare is assessed using a 2nd-order approximation to the utility of the representative consumer. It’s a very nice paper for its time. Blessedly simple by today’s standards. The empirical part of the paper (section 5.1, p. 723) is about as simple as it gets. The model is described as calibrated for a particularly simple benchmark version. Most parameters are standard ones. The degree of openness is backed out of the share of imports to GDP for Canada “which we take as a prototype small open economy” (p. 723). The policy rule is standard Taylor (1993). They “calibrate the stochastic properties of the exogenous driving forces” using simple AR(1) models of HP-filtered data for Canada and the U.S. from the period from 1963:Q1 to 2002:Q4, from which they calibrate processes for SOE productivity and foreign potential output. That’s it. This paper is not estimated in any meaningful sense of that term, nor is it a U.S. model.

**NK\_GS14** Gambacorta, Leonardo, and Federico M. Signoretti (2014) “Should monetary policy lean against the wind? An analysis based on a DSGE model with banking” *Journal of Economic Dynamics & Control*,43: 146-174.

The selling point of this paper that appeared in a special issue of the JEDC, co-edited by Damjan Pfajfar, is the use of a DSGE model that includes a balance-sheet channel and a bank-lending channel of transmission, which bring into play the spread between lending and policy rates determined, in part, by bank leverage. (Elsewhere, they describe these as two financial frictions, entrepreneurs’ borrowing capacity is constrained by the value of the assets that hold, and banks have a target level of leverage with costly deviations from that target. The former is sometimes referred to as the collateral channel.) The model is a simplified version of Gerali , Neri, Sessa & Signoretti (JMCB, 2020) which is explicitly a model of the Euro area. The balance-sheet-cum-collateral channel is non-linear, which means that exploring it properly requires a nonlinear solution algorithm. The authors instead solve a linearized version of the model around a steady state in which the borrowing constraint is always binding and explore what difference it makes if the constraint is binding at a different value. What one would hope is the own rule in the MMB store of the model is a inertial Taylor-type rule that allows for feedback on the value of capital and bank leverage. The calibration comes mostly from that of the Gerali et al. paper. I don’t see anything in this paper that is estimated and it doesn’t seem to have anything, per se, to do with the U.S. economy.

**NK\_AFL15**. Angeloni, Ignazio; Ester Faia and Marco Lo Duca (2015) “Monetary policy and risk taking” *Journal of Economic Dynamics & Control*,53: 285-307.

The authors present some empirical evidence, using VAR models, to support the notion that risk taking varies over the business cycle in general and with monetary policy more specifically. From that, they construct a DSGE model based on Diamond and Rajan (2000,2001) that encompasses a channel where bank managers allocate funding sources between retail deposits and equity, in an environment where the risk faced by banks is idiosyncratic (private) information. The estimation part uses U.S. data from 1980:Q1 to 2008:Q4, augmenting the standard variables with measures of bank funding risk, lending risk and total bank risk. Then they write down a DSGE model with potential fundamental bank runs. Details related to our variables: sticky prices based on Rotemberg quadratic adjustment costs. Inertial Taylor-type monetary policy rule. That appears to be about it. Section 5.7 is titled “Parameter values” and it covers the calibration. “In order to parameterize the degree of price stickiness, we rely on the comparison between the slope of the log-linear Phillips curve in our model, with that arising under a Calvo-Yu setup,” meaning they calibrate the PC of their model to emulate that of a different (U.S.) model. This model is a U.S. model and is calibrated.

**NK\_BGG99.** Bernanke, Gertler & Gilchrist (1999). I know this paper well. It is a calibrated U.S. model.

**NK\_BGUS2010**. Blanchard, Olivier and Jordi Gali (2010) “Labor markets and monetary policy: a new Keynesian model with unemployment” *AEJ:Macro*,2:-1-30. Perhaps the first paper to embed a Diamond-Mortensen-Pissarides search-and-matching labor market in a DSGE framework. They present both U.S. (“fluid labor market”) and continental EU (“sclerotic labor market”) calibrations. I gather MMB stores both and is careful to distinguish the two. Pertinent features in terms of RHS variables for our work: Calvo probs of price adjustment; no indexing. Nash bargaining of wages determine how the fundamental surplus gets divided; this implicitly determines the wage rate. Real wage rigidities are introduced in a crude way. This is a U.S. calibrated model.

**NK\_CFP2010** Carlstom, Charles T.; Timothy S. Fuerst and Matthias Paustian (2010) “Optimal monetary policy in a model with agency costs” Journal of Money, Credit and Banking,42(S1): 37-60.

Agency costs introduced into a standard NK model. Agency costs of the Kiyotaki-Moore type costly state verification setup are a source of endogenous markup shocks in the output-gap version of the NK PC. Pertinent features in terms of RHS variables for our work: Rotemberg quadratic adjustment costs of adjusting prices. Zero inflation at all dates still ends up being pretty close to the optimal policy, despite the added distortion. Calibration is based in part on that of the canonical NK model of Woodford (2003); credit related parameters are based on the proportion of small firms in the U.S.. This is a U.S. calibrated model.

**NK\_CK08** Christoffel, Kai and Keith Kuester (2008) “Resuscitating the wage channel in models with unemployment fluctuations” *Journal of Monetary Economics*,55(5): 865-887.

DMP search-and-matching added to standard model with right-to-manage (Nash) bargaining (Trigari, 2006) determining the split of the fundamental surplus. RTM results in a constant share of revenue accruing to workers; fixed costs in hiring ameliorates this counterfactual implication and are therefore emphasized. Pertinent features in terms of RHS variables for our work: Calvo stickiness *of wages* and prices, and RTM determining employment, given the wage bargain. Inertial Taylor-type rule feeding back on *year-over-year* inflation and output deviations from steady state. Calibration is to H-P filtered U.S. data from the period from 1964:Q1 to 2006:Q3. This is a calibrated U.S. model.

**NK\_CW09**. Published as Curdia, Vasco and Michael Woodford (2016) “Credit frictions and optimal monetary policy” *Journal of Monetary Economics*,84: 30-65.

The canonical NK model is extended to allow for micro-founded spreads between saving and borrowing rates. A simple “targeting rule” continues to be optimal monetary policy, implemented by a forward-looking Taylor rule adjusted for current and expected future credit spreads. Many of the parameters of the model are also the those of the standard NK model. Inflation is quarterly. The policy rule is a static Taylor rule, albeit with a different calibration. This is a calibrated model and is U.S. in the sense that it’s close to the standard NK model which is usually taken to be a U.S. calibration.

**NK\_DEFK17**. Del Negro, Marco; Gauti Eggertsson, Andrea Ferrero and Nobro Kiyotaki (2017) “The great escape? A quantitative evaluation of the Fed’s liquidity facilities” *American Economic Review*,107(3): 824-857.

Reduced-form financial frictions of the Kiyotaki-Moore variety are embedded in a “relatively standard DSGE model along the lines of Christiano, Eichenbaum and Evans (2005) and Smets and Wouters (2007).” They describe the model as KM augmented with nominal and real frictions. At the heart of the model is a convenience yield (Krishnamurthy and V-J, 2012) associated with the liquidity provided by Teasuries. Taylor-type rule, subject to the ZLB. Calibrated model, at quarterly frequency, using U.S. data from 1953:Q1 to 2008:Q3 “to compute our targets.” There are little bits of estimation in order to come up with some of the KM/financial friction parameters. Absent nominal rigidities, liquidity shocks would only affect the composition of output with little effect on aggregate activity. This is a U.S. calibrated medium-scale model.

**NK\_DT12**. De Fiore, Fiorella; and Oreste Tristani (2013) “Optimal monetary policy in a model of the credit channel” *Economic Journal*,123:906-931.

Another model that extends the basic NK model to allow for credit frictions and thus differences between lending and borrowing rates, in this case through asymmetric information and default risk. I.e., the costly state verification friction of Townsend (1979). Firms have to borrow working capital to pay wages in advance of revenues. Financial market fluctuations become a source of MC shocks. The paper that’s closest to this one is Curdia and Woodford (2010). Sticky prices via Calvo; no indexation. Some of the parameters are calibrated to match the unconditional moments of the data; the references lead one to think the calibration is to the U.S. data. More important, the Phillips curve is estimated using GMM following the methodology of Gali and Gertler (1999) and Ravenna and Walsh (2006), using several sample periods, each starting in 1960:Q1 and ending in any of 2001:Q1, 2007:Q2 and 2010:Q1. They test the validity of the cost channel and credit channel. Critical here, it seems to me, is the measurement of marginal costs. They’re careful, using the correction for firm-specific capital derived by Sbordone (2002). This is a tough call. There is a non-trivial amount of estimation in this model, but the dynamics of the model as shown in the IRFs look toy-like; that is, they don’t have the hump shape that is regarded as plausible. I guess I’d still call it a calibrated model, but I would welcome other views.

**NK\_FLMF18** Filardo, Andrew; Macro Lombardi, Carlos Montoro and Massimo Ferrari (2018) “Monetary policy spillovers, global commodity prices and cooperation” BIS working paper no. 696 (January).

A version of the multi-country DGSE model of Nakov and Pescatori (2010) is used to look at the questions in the title. Their results are conventional: if CBs can identify the shocks they do better by customizing policy responses to those shocks; otherwise targeting core inflation is generally better. In typical BIS thinking, they say CBs need to pay more attention to global factors when formulating monetary policy. Calvo pricing; no indexation. The small bits they have about calibration (pp. 24-5) suggest that this is a U.S. model.

**NK\_GHP16**. Gnocchi, Stefano; Deniela Hauser and Evi Pappa (2016) “Housework and fiscal expansions” *Journal of Monetary Economics*,79: 94-108.

An otherwise standard NK model has housework added and is calibrated to be consistent with time-use data to model the complementarity of housework and hours worked for consumption. Calvo price stickiness, without indexing. Inertial Taylor-type rule written with an output growth term in addition to the gap term with both defined in terms of deviations from the flex-price equilibrium. The time-use data is from the American Time Use Survey; otherwise, U.S. data from BEA are used to calibrate the size of the home sector relative to the market economy, 1950:Q1-2007:Q2. This is a U.S. calibrated model.

**NK\_GK09** and **NK\_GK09lin**. Gertler and Karadi (2011). I know this paper and it’s a U.S. calibrated model.

**NK\_GK13**. Also a U.S. calibrated model. Even more complicated than NK\_GK09.

**NK\_GLSV07** Gali, Jordi; David Lopez-Salido and J. Valles (2007) European Economic Review

I agree that it’s a calibrated model of the U.S. economy.  Footnote 9 contains the details.  If we’re going to maintain some notes on what we see, let me observe that the some of the calibration comes from fitting a VAR model for the period from 1954:Q1 to 2003:Q4.

**NK\_GK07.** Goodfriend, Marvin and Bennett McCallum (2007) “Banking and interest rates in monetary policy analysis: a quantitative exploration” *Journal of Monetary Economics*,54: 1480-1507.

A Carnegie-Rochester paper that represented one of the early efforts to get banks into a micro-founded GE model, calibrated to U.S. data. A bank-deposits-in-advance constraint drives the holding of ‘money,’ and Marvin and Ben assume the constraint always binds. There are 12 parameters, six are borrowed from the conventional model without banking. The rest are chosen for their plausibility. Nothing fancy. The model is clearly a U.S. calibrated model.

**NK\_GSSZ1** etc. Gilchrist, Simon; Raphael Schoenle, Jae Sim and Egon Zakrajsek (2017) “Inflation dynamics during the financial crisis” *American Economic Review*,107(3): 785-823.

A customer markets model of pricing combines with financial frictions results in firms that ‘underprice’ their final goods, in some sense of that term, in normal times in order to build up goodwill (and thus repeat business) among customers. But when there is a financial crisis such that they need to hoard cash, they raise prices (relative to the frictionless price) in order to preserve cash on hand. The authors use cata from Compustat along with PPI data to show that firms that were not credit constrained lowered their prices during the GFC, whereas constrained firms did not. The empirical part motivates a DSGE model. Rotemberg quadratic costs of adjusting prices, with external habits in consumption and customer habits (both of which impart some persistence). Financial frictions have two effects on inflation dynamics, one a cost channel working through markups, the other the effect on the rate at which figure dividends are discounted. Monetary policy is governed by an inertial Taylor-type rule. This model is a calibrated U.S. model.

**NK\_IR04.** Ireland, Peter (2004) “Money’s role in the monetary business cycle” *Journal of Money, Credit and Banking*,43(1): 969-983.

A forward-looking Phillips curve which has real money balances in it requires the same in a forward-looking intertemporal IS curve, which will happen when utility is non-separable. Ireland constructs and estimates such a model, taking care to measure and adjust for shifts in the demand for real money balances. Money does come into the model empirically, but its implications are small. Rotemberg-style quadratic adjustment costs of changing prices, measured around the steady-state inflation rate. You get the same thing, however, with Calvo. A Taylor-type rule with the policy rate reacting to *lagged* output gaps and inflation closes the model. The model is estimated using linearly detrended U.S. data for the period from 1980:Q1 to 2001:Q3 via FIML. My sense is that this model is listed as calibrated because Ireland, dissatisfied with some of his empirical results, imposes some parameters and estimates a constrained ML model. I don’t know which version of the model is stored in MMB. Even if it is the version where some key parameters are imposed, it’s hard to say whether Ireland’s mixed calibration and estimation procedure is any more influential than estimating the model employing Bayesian priors would be. If forced to choose without going through everything in detail, I’d call this a U.S. *estimated* model, but a good case can be made that we shouldn’t override the call that the MMB folks made.

**NK\_JO15.** Jang, T.S. and E. Okano (2015) “Productivity shocks and monetary policy in a two-country model” *Frontiers of Economics in China*. Higher Education Press, 10: 102-121. I plucked a draft of this paper from the dynare working paper series, December 2013.

Two-country NK model with cost channel a la Ravenna and Walsh (2006). The model is most like Gali and Monacelli (2005). Sticky prices as in Calvo-Yun, apparently without indexation. Policy is governed by inertial Taylor-type rules feeding back on CPI inflation and the output gap (measured in terms of deviations from flex-price equilibrium). In this version of the paper, at least, it is not clear where the calibration comes from—the parameters seem to be plucked out of thin air—or what countries the model represents. Left to my own devices, I’d be inclined to drop this model from our set.

**NK\_KM16**. Krause, Micheal U. and Stephane Moyen (2016) “Public debt and changing inflation targets” *AEJ:Macro*,8(4): 142-176.

NKB model with two non-standard features: (1) a stochastic inflation target and agents that have imperfect information regarding the current target and therefore have to estimate it; and (2) long-term government debt in the form of perpetuities with stochastic arrivals of call dates. They calibrate their model to the U.S. “for concreteness” with an average maturity of debt of 5-1/2 years. Policy follows an inertial Taylor-type rule with a stochastic target rate of inflation. Prices are sticky via Calvo and indexation either to the stochastically varying target rate of inflation, or in the imperfect information case, to the actual inflation rate. (Which one do we have stored?) Wages are not sticky but a footnote says that their results are robust to adding stickiness to wages as in EHL (2000). This is a U.S. calibrated model.

**NK\_KRS12.** Kanna, Prakash; Pau Rabanal and Alisdair M. Scott (2012) “Monetary and macroprudential policy rules in a model with house price booms *B.E. Journal of Macroeconomics,*12(1): article 16 (Contributions).

Modified closed-economy NK model, along the lines of Iacoviello (2005), Iavoviello and Neri (2010) and Monacelli (2009). There are financial intermediaries, borrowers and lenders, and spreads. Two sectors—durable and nondurable goods—both with sticky prices a la Calvo—and costly adjustment between sectors. They base their calibration of most parameters on the estimated paarameters of Iacoviello and Neri (2010), adjusting where necessary to match the pertinent second moments of the U.S. data. It isn’t clear from what period of the data the calibration is based. This is a U.S. calibrated model.

**NK\_KW16.** Kirchner, Markus and Sweder van Wijnbergen (2016) “Fiscal deficits, financial fragility and the effectiveness of government policies” *Journal of Monetary Economics*,80: 51-68.

Asset choice and sovereign debt holdings are introduced into an otherwise standard macroeconomic model with financial frictions to examine crowding out of private investment by leverage-constrained banks that accumulate public debt. The EA sovereign debt crisis is the motivating event. The results are as you would expect. The model is based on CEE (2005) and Gertler and Karadi (2011) but has two intermediaries: banks, which suffer from informational frictions, and money market funds, which do not. “For comparability with the existing academic literature we have chosen parameters that are commonly used in similar DSGE models.” In footnote 7, they add that “A large fraction of those parameters is based on attempts to match moments of the U.S. data. We do not want to imply that the mechanisms we discuss are particularly relevant to the U.S., given the relatively small role banks play in U.S. debt markets. But the interaction between bank balance sheets and sovereign debt has been at the core of the euro area crisis and is also relevant in most emerging markets.” A few of the financial variables are based on data from 1986:Q1 to 2007:Q4. There is a bit of moment matching estimation in their Table 2, mostly to get the standard deviations of shocks that line up with second moments of the data. All told, this is a calibrated U.S. model, based on pre-2008 data.

**NK\_MCN00cr**. McCallum, Bennett and Edward Nelson (1999) “Performance of operational policy rules in an estimated semi-classical structural model” (The ‘cr’ refers to the Calvo-Rotemberg version of their model).

The title says it’s an estimated model and yet it’s listed as calibrated? This is apparently because the “Calvo-Rotemberg price-setting” version has some coefficients imposed; in particular, the slope of the NK Phillips curve is set to a larger number than would be estimated because it “is required to produce plausible inflation variability.” That parameterization has some knock-on implications for a couple of others. The paper walks the reader through some IV estimation. Inertial Taylor-type rule (eq. 50), is one of the estimated equations. This is clearly a U.S. model. As with NK\_IR04 above, it is not clear (to me) whether to call it estimated or calibrated.

**NK\_MI14.** Michaillat, Pascal. (2014) “A theory of countercyclical government multiplier” *AEJ:Macro*,6(1): 190-217.

A NK model with convex quasi-labor supply curve is derived, by adding a form of DMP seach and matching, that implies that fiscal policy can crowd out private employment, depending on where on the LS curve you start from. Price adjustment is subject to Rotemberg quadratic adjustment costs. There is a simple surplus sharing rule that determines the real wage, borrowed from Blanchard and Gali (2010). Policy is inertial but feeds back only on inflation. Calibration is for a model of *weekly* frequency, based on U.S. data (of lower frequency) over a variety of date ranges. This is a calibrated U.S. model.

**NK\_MM10.** Meh, Cesaire A. and Kevin Moran (2010) “The role of bank capital in the propagation of shocks” *Journal of Economic Dynamics & Control*,34: 555-576.

An medium-scale NK model along the lines of CEE or SW is augmented with banks and bank capital that serves to mitigate the agency problem between lenders and entrepreneurs. Two sources of moral hazard: one for banks and the other for entrepreneurs; Holmstrom and Tirole (1997). Bank capital determines the loanable funds of banks, greatly amplifying and propagating technology shocks. Nominal stickiness follows EHL (2000) which means Calvo arrivals of reoptimization of wage rates, with indexation to last period’s inflation, when applicable. Same goes on the price side for intermediate goods producers. Monetary policy is governed by an inertial Taylor-type rule in the inflation gap and the deviation of output from steady state, with parameters taken from CGG (2000). Habit persistence in consumption with the habit parameter, 0.65, taken from CEE (2005), as are the wage and price-setting parameters. This is a calibrated U.S. model.

**NK\_MPT10**. Monacelli, Tommaso; Roberto Perotti and Antonella Trigari (2010) “Unemployment fiscal multipliers” *Journal of Monetary Economics*,57(5): 531-553.

A standard neoclassical model augmented with DMP search-and-matching frictions (and Nash bargaining over the fundamental surplus) does not replicate the one-year output fiscal multiplier of 1.2 that the authors estimate using a VAR a la Blanchard and Perotti (2002). It can produce the peak unemployment multiplier of -0.6 but only under special parameterizations. It takes strong complementarities in preferences and price stickiness to get decent multipliers. There are a bunch of model specifications discussed in the paper. Job separation rate is based on Shimer (2005). Monetary policy is implemented using a non-inertial Taylor-type rule that feeds back on inflation and output *growth*, with the output coefficient scaled for their monthly frequency model. The calibration of the price stickiness part, which comes very late in the paper and gets only cursory description as to methodology, is to “a four-quarter degree of price stickiness.” In any event, this is a calibrated U.S. model.

**NK\_NS14**. Nakamura, Emi and Jon Steinsson (2014) “Fiscal stimulus in a monetary union: evidence from U.S. regions” *American Economic Review*,4:753-792.

N&S treat U.S. states as open-economy countries in a monetary union and exploit the regional variation in price movements to identify effects of fiscal policy shocks (as measured by military expenditures). The open-economy relative multiplier, as they call is, is 1.5 and they infer the standard closed-economy multiplier (imprecisely estimated) from those OERMs. Sticky prices via Calvo. No indexation. The calibration is taken from various papers covering various era of U.S. history. The empirical work that comprises the first two sections of the paper is on U.S. states and fiscal policy shocks. The model is an small open economy model that is nonetheless calibrated to macro U.S. data. The authors go through many versions of their model in the paper. It’s important to pin down which has been stored in MMB, if only to get the RHS variables properly classified. Regardless, this is a calibrated U.S. model.

**NK\_PP17.** De Paoli, Bianco and Matthius Paustian (2017) “Coordinating monetary and macroprudential policies” *Journal of Money, Credit and Banking*,49: 319-349.

NK model with a financial friction as in Gertler and Karadi (2011) is used to examine coordination as a noncooperative game. If friction is equal in its effects on factors of production, macpru is powerful, delivering first best outcomes. Otherwise, institutional arrangements regard which authority has responsibility for what become important. Coordination yields superior outcomes relative to the Nash solution, but a Stackelberg game with macpru leadership can do better. Firms have to finance payroll in advance as in Ravenna and Walsh (2005), which gives rise to a cost channel of monetary policy; i.e., the policy rate appears in the Phillips curve, multiplied, in this case, by a term capturing the cash-in-advance-like financial friction. Capital is fixed in quantity but the authors want the intensity of capital utilization to matter, so they put that into the household’s utility function. Quadratic adjustment costs of changing prices, measured around the steady-state inflation rate (which is zero in any event), as in Rotemberg (1982), with the cost parameter calibrated to give the equivalent of an average price duration of five quarters, in Calvo terms. The model is calibrated to U.S. data. This is a calibrated U.S. model.

**NK\_RA16**. Rannenberg, Ansgar (2016) “Bank leverage cycles and the external finance premium” *Journal of Money, Credit and Banking*,48: 1569-1612.

A fusion of Gertler-Karadi (2011) with Bernanke, Gertler and Gilchrist (1999) produces a DSGE model with leverage constraints in both banking and the nonfinancial sector. BGG gives rise to external finance premia; GK gives rise to a bank capital channel. The author works with three versions, one with BGG features only, one with GK features only, and one with both. Calvo price frictions, with indexation to a weighted average of past inflation and steady-state inflation (of zero). The author calibrates each model differently to U.S. data, over the period from 1990:Q1 to 2013:Q4. As you might expect, the GK moral hazard friction between banks and entrepreneurs amplifies the EFP effect of BGG. A “reasonably calibrated” combination of balance sheet shocks produces “a substantial share” of the increase in the external finance premium and the contract in investment observed in the GFC. This is a calibrated U.S. model. Inertial Taylor-type rule defined in inflation and the output gap. This is a calibrated U.S. model.

**NK\_RW06.** Ravenna, Federico and Carl Walsh (2006) “Optimal monetary policy with the cost channel” *Journal of Monetary Economics*,53(2): 199-216.

The paper that introduced the cost channel to monetary economics, which turned out to be timely for helping to explain why inflation didn’t fall through the floor during the GFC (although that’s not the only story for that non-occurrence). R-W observe that an *ad hoc* cost shock is typically added to the NK PC in order to avoid “divine coincidence” outcomes; as in CEE (2005). The authors show that cost shocks arise endogenously if the cost channel is introduced into NK models in the form of firms having to borrow in advance to meet payroll. But the implication of a cost channel isn’t just the justification of a cost shock but rather is the welfare and MP implication that neutralization of shocks to the IS curve is no longer optimal. Calvo specification for stocky prices with indexation to steady-state price inflation. The authors do some GMM estimation with U.S. data to establish the relevance of cost to the NK PC. But these estimates do not appear to play a role in the model that is used for simulations, which uses “fairly standard” calibrated values, although the Calvo parameter of 0.75 is “consistent with the empirical findings…reported in Section 3.” This is a calibrated U.S. model.

**NK\_RW97**. Rotemberg, Julio and Michael Woodford (1997) “An optimization-based econometric framework for the evaluation of monetary policy” *NBER Macroeconomic Annual*,12: 297-346.

The granddaddy of NK models. Despite the word “econometric” in the title, this is a calibrated U.S. model.

**NK\_ST13.** Stracca, Livio (2013) “Inside model in general equilibrium: does it matter for monetary policy?” *Macroeconomic Dynamics*,17: 563-590.

A NK model is extended to allow for inside money which has a small but nonnegligible effects of inside money shocks on output and inflation and slight attenuation of the effects of productivity and MP shocks. Banking arises through a deposit-in-advance constraint, much like Ravenna-Walsh, with some handwaving about the Kiyotaki-Moore moral hazard motivation for a financial friction partially alleviated by banks. Adjusting (real) deposit levels is costly for households in utility terms. All this gives rise to a “theoretical inside money demand function” that equates the tightness of the deposit-in-advance constraint with the expected cost of foregone interest income. There are quadratic costs of adjusting prices, as in Rotemberg (1982). There is no indexing. Monetary policy is governed by an inertial Taylor-type rule in inflation only. Calibration “standard in the literature, and is largely based on producing key moments of the endogenous variables that are realistic.” What references there are to data—the stuff that is new to this model; e.g., money demand, interest spreads—are to U.S. sources. Shock variances are taken from a VAR model. This is a calibrated U.S. model.

**Models that Connor Examined**

NK\_DEFK17 -- "The Great Escape? A Quantitative Evaluation of the Fed’s Liquidity Facilities"

This paper uses two credit frictions to demonstrate that unconventional monetary policy with private assets are not irrelevant—i.e., challenging Wallace (1981) where there is no role for liquidity at the ZLB. These credit frictions are the financing constraint and, the key part, the resaleability constraint (that one can only sell a certain percentage of illiquid private assets while government paper is completely liquid). They based the model on Kiyotaki and Moore and model a shock to the resaleability of private paper to “replicate” the 2008 crisis. They borrow Krishnamurthy Vissing-Jorgensen (2012)’s estimate of a convenience yield and have "remaining targets are chosen to pin down the other steady-state parameters…choose them as to minimize the squared deviations of the model implied values from the data." Overall, this model seems fully calibrated and based on the U.S., so I’d recommend keeping it calibrated.

NK\_ET14 – “Unconventional government debt purchases as a supplement to conventional monetary policy”

Another paper on unconventional monetary policy instruments, this one advising that LSAP should be part of the normal toolbox for stabilizing output and inflation. See Table 1 for a full calibration list based on Gali (2008) and Smets and Wouters (2003 and 2007). The model appears fully calibrated and based on the U.S.

NK\_GHP16 – “Housework and fiscal expansions”

This paper investigates the size of the fiscal multiplier, focusing on the complementarity between consumption and hours worked. They find that the substitutability between home and market goods supports complementarity driving a large fiscal multiplier effect. I found the paper fairly difficult to follow but it seemed to me that it was calibrated. That said, I would ask if either of you might be able to take a look. They mentioned they use the American Time Use Survey from 2003-2010 but I don’t think this works into their parameters.

NK\_GLSV07 – “Effects of Government Spending on Consumption”

This paper examines why consumption rises in response to an increase in government spending, and they model this by assuming strictly hand-to-mouth households (they call it “rule-of-thumb”). Despite being published in a European journal, the paper is based on US data, using data from Estima’s USECON. It also uses a model rule of a Taylor (1993) rule but instead with a a coefficient of 1.5 on inflation and 0 on output gap. It appears that all parameters are calibrated except for ϕg, which “is obtained as the difference of the VAR-estimated impact effects of government spending and deficit.”