# Fiscal Multipliers in Austria: A Unified Framework

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# Motivation

- The estimation of fiscal multipliers (the ratio of the change in output to an exogenous change in government spending or taxes) is a central element in the evaluation of fiscal policy
- The precision in the estimation of fiscal multipliers contributes significantly to the quality of GDP growth predictions (Blanchard and Leigh, AER 2013)
- The estimates of fiscal multipliers in literature (even for the same country/time period) are notoriously heterogeneous
- How sensitive are estimates of fiscal multipliers for Austria to methodological choices by the econometricial?
- We concentrate on fiscal multipliers estimated using structural VAR and FAVAR models and examine methodological choices related to:
  - Data definitions and transformations
  - Variables, lag length choice, deterministics in VAR model
  - Identification strategy for structural shocks

# Fiscal multipliers and model uncertainty

- Čapek and Crespo Cuaresma (OBES 2019) find that seemingly unimportant modelling choices (expenditure/tax definition, smoothing of data, deflator choice, data source ...) can have sizeable effects on the estimates of fiscal multipliers
- We entertain a large number of VAR and FAVAR models based on different choices of data definitions, specification choices and identification schemes
- We evaluate the range of multiplier estimates obtained and use out-of-sample predictive ability as a measure to discriminate among them

# SVAR models and shock identification

- Consider a reduced-form VAR model with macroeconomic and fiscal variables,

$$Y_t = \mu + M(L)Y_{t-1} + U_t,$$

where $A(L) = \sum_{j=0}^{p-1} M_j L^j$ is a lag polynomial and $U_t$ is a vector of potentially correlated error terms with $E(U_t U_t') = \Sigma_U$

- The vector of reduced-form shocks are related to (mutually uncorrelated) structural shocks through the matrices $B$ and $A_0$, so that

$$B\varepsilon_t = A_0 U_t$$

Restrictions on $B$ and $A_0$ need to be imposed to identify the structural shocks.

# The Recursive Approach

- Assuming $B = I$ and a lower-triangular $A_0$ matrix with unit diagonal implies a recursive structure in the reduced-form shocks.

- The VCV matrix of the reduced-form shocks is $\Sigma_u = A_0^{-1}\Sigma_\varepsilon(A_0^{-1})'$, which can be obtained using the Cholesky decomposition of $\Sigma_u$ after assuming a causal ordering of the shock responses:
  - spending
  - output
  - (prices)
  - taxes
  - (interest rates)

# The Blanchard-Perotti Approach

- In the simple three-variable case put forward by Blanchard & Perotti (QJE 2002),

$$
\begin{aligned}
t_t &= a_1 x_t + a_2 \varepsilon_t^g + \varepsilon_t^t \\
g_t &= b_1 x_t + b_2 \varepsilon_t^t + \varepsilon_t^g \\
x_t &= c_1 t_t + c_2 g_t + \varepsilon_t^x
\end{aligned}
$$

- Blanchard & Perotti fix the values of the parameters in this system by constructing the elast. to output of government purchases and of taxes, use the cyclically adjusted series as instruments to obtain $c_1$ and $c_2$ and then alternatively assume $a_2 = 0$ or $b_2 = 0$

# The Sign Restrictions Approach

Structural shocks can be identified via sign restrictions on the impulse responses of the VAR model:

- business cycle shock: the impulse responses of output and taxes are positive for at least the four quarters following the shock
- tax shock: the impulse responses of taxes are positive for at least the four quarters following the shock (and the shock is orthogonal to the business cycle shock)
- government spending shock: the impulse responses of government spending are positive for at least the four quarters following the shock (and the shock is orthogonal to the business cycle shock)

# FAVAR Specifications

- Pre-announced fiscal policy changes may lead agents to change their behaviour prior to the realization of the shock (fiscal foresight)
- This implies that the information set of agents is actually larger than that of the econometrician
- Expand the VAR structure with factors extracted from a panel of 26 additional time series that relate to macroeconomic dynamics, financial markets and the labour market
- Uncertainty about the number of factors included in the FAVAR specification is explicitly included in our multiplier estimates for this type of specification

# From the (FA)VAR model to fiscal multipliers

We concentrate on **discounted cumulative** multipliers at time $T$, defined as

$$m(T) = \frac{\sum_{t=0}^{T}(1+i)^{-t}y_t}{\sum_{t=0}^{T}(1+i)^{-t}g_t}\frac{1}{g/y},$$

where $i$ is the interest rate, $y_t$ is the response of output at time $t$, $g_t$ is that of government expenditures at time $t$ and $g/y$ is the average share of government expenditures in GDP over the sample, as well as on **peak multipliers**

$$\frac{\max_{t=0,\ldots,H}\{y_t\}}{\max_{t=0,\ldots,H}\{g_t\}}\frac{1}{g/y}$$

for $T = 4$ and $H = 8$ quarters

# Modelling choices

Differences across modelling frameworks emerge from:

- the group of macroeconomic variables included in the SVAR/FAVAR model
- the definition of the government spending and tax variables, as well as other macroeconomic covariates
- the specification of the VAR and FAVAR models in terms of inclusion of deterministic terms, lag length and number of factors

| **Dimension** | **Variants considered** |
|---|---|
| Government data composition | 9 variants |
| Deflating index | GDP deflator and HICP (not lagged and lagged by 4q) |
| Model | VAR and FAVAR models with 3–5 vars |
| Identification strategy | Cholesky ordering, Blanchard-Perotti, sign restrictions |
| Number of factors | 1–2 (FAVARs only) |
| Deterministics and lags | Constant or linear trend, 1–4 lags |

# Modelling choices

- Government data composition:

| **Gov't spending composition** | **Gov't revenues composition** |
|---|---|
| | Taxes on prod., imp., inc. & wealth |
| Comp. employ., interm. cons., GCF | Baseline adjusted for actual soc. cont. |
| Baseline + social benefits | Baseline adjusted for soc. cont. and subsidies |
| | Base + hh soc. cont. |
| Baseline (gross fixed cap.) + transf. kind | Base + hh soc. cont. adj. for subs. |
| | Base + hh soc. cont. adj. for subs./trans. |
| Base + acquisitions of assets | Base+ hh soc. cont. adj. for subs./trans. (+ cap.trans.) |
| Total exp. - subs. & various transf. | Total rev. - subs./transf. & various transf. |

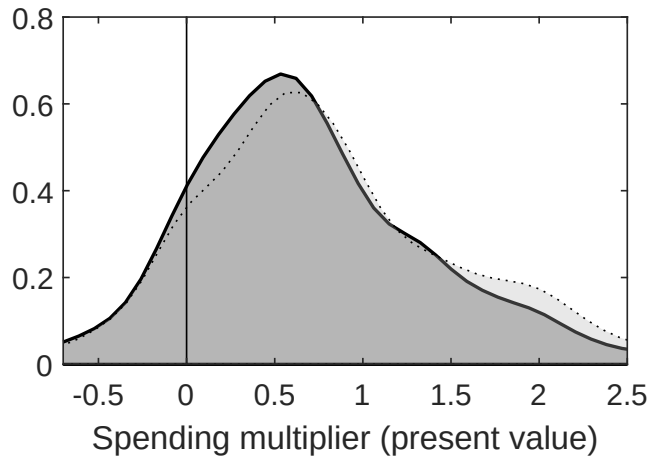
- Data source is Eurostat, covering the period 2001Q1 - 2018Q4 (72 observations)
- Bootstrap used to obtain the model-specific distribution of multiplier estimates, median used as estimate (2,987 multipliers)

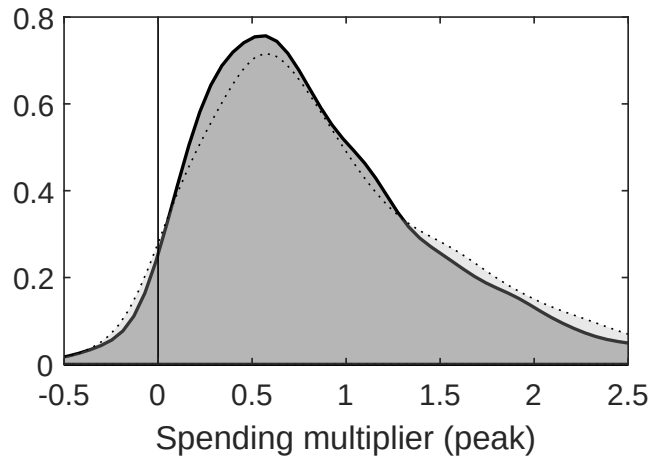
# Multiplier estimates

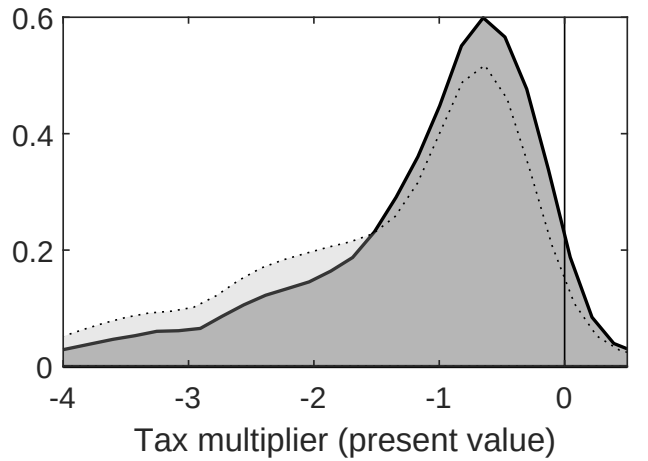
- Descriptive statistics for the full set of multiplier estimates, as well as for those obtained by the 40% best models in terms of out-of-sample predictive ability (MAE) for 2018

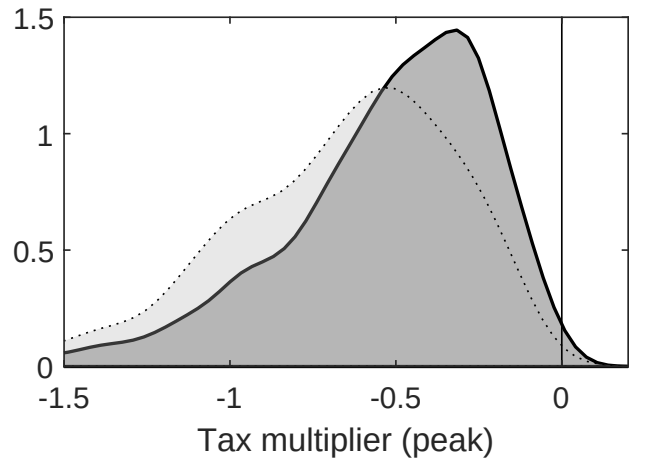
| **Multiplier type** | **min** | **16-th p.** | **mean** | **median** | **84-th. p** | **max** |
|---|---|---|---|---|---|---|
| Spending multiplier (p.v.) | -4.52 | 0.05 | 0.68 | 0.60 | 1.39 | 3.39 |
| — best 40% | -4.52 | 0.07 | 0.79 | 0.69 | 1.60 | 3.39 |
| Tax multiplier (p.v.) | -9.20 | -2.15 | -1.12 | -0.85 | -0.28 | 7.03 |
| — best 40% | -9.20 | -2.67 | -1.41 | -1.06 | -0.42 | 7.03 |
| Spending multiplier (peak) | -1.58 | 0.27 | 0.85 | 0.72 | 1.47 | 3.49 |
| — best 40% | -0.74 | 0.27 | 0.90 | 0.77 | 1.59 | 3.49 |
| Tax multiplier (peak) | -2.76 | -0.85 | -0.54 | -0.47 | -0.24 | 0.08 |
| — best 40% | -2.76 | -1.02 | -0.68 | -0.61 | -0.32 | 0.08 |

# Fiscal Multipliers in Austria



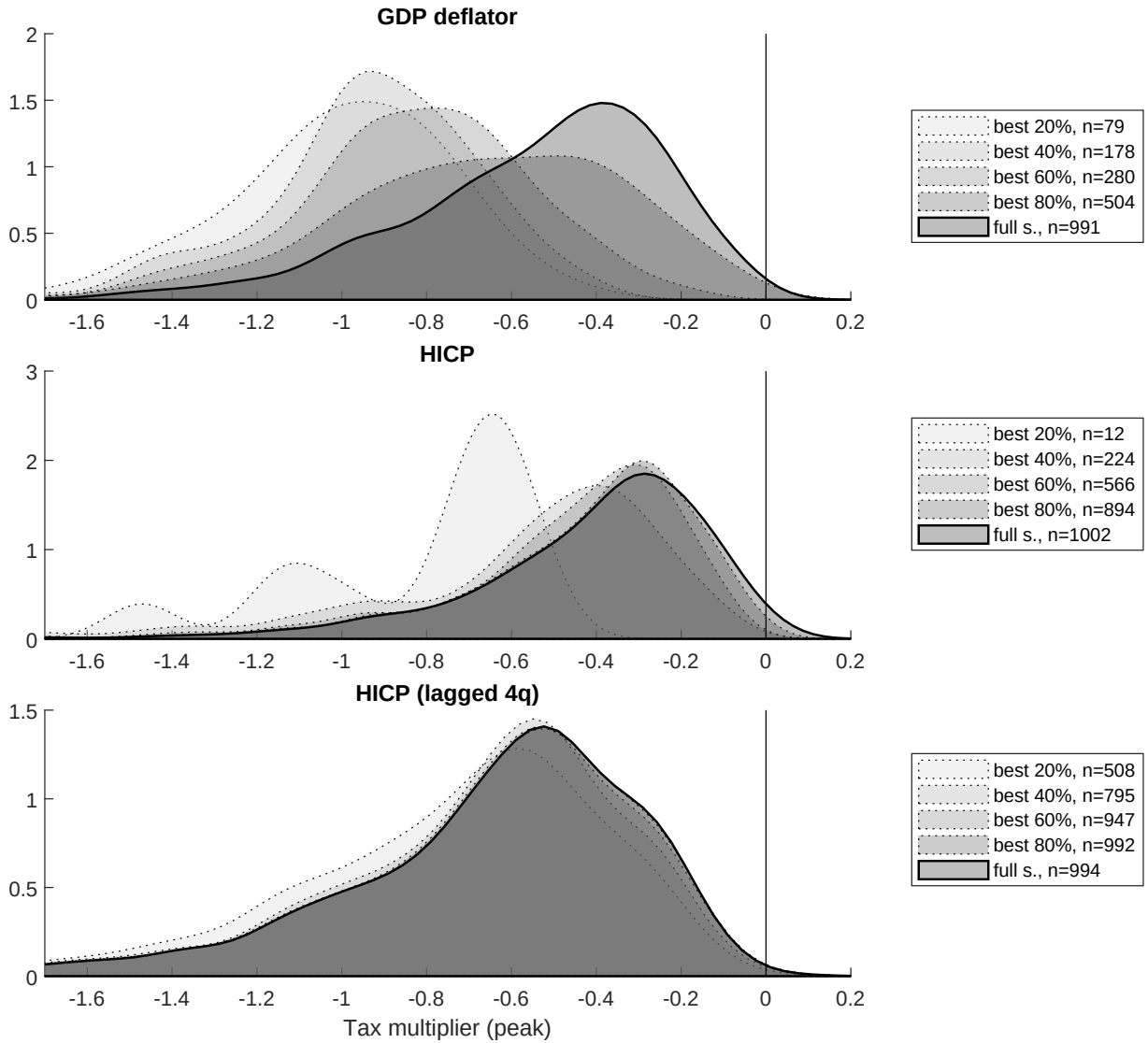



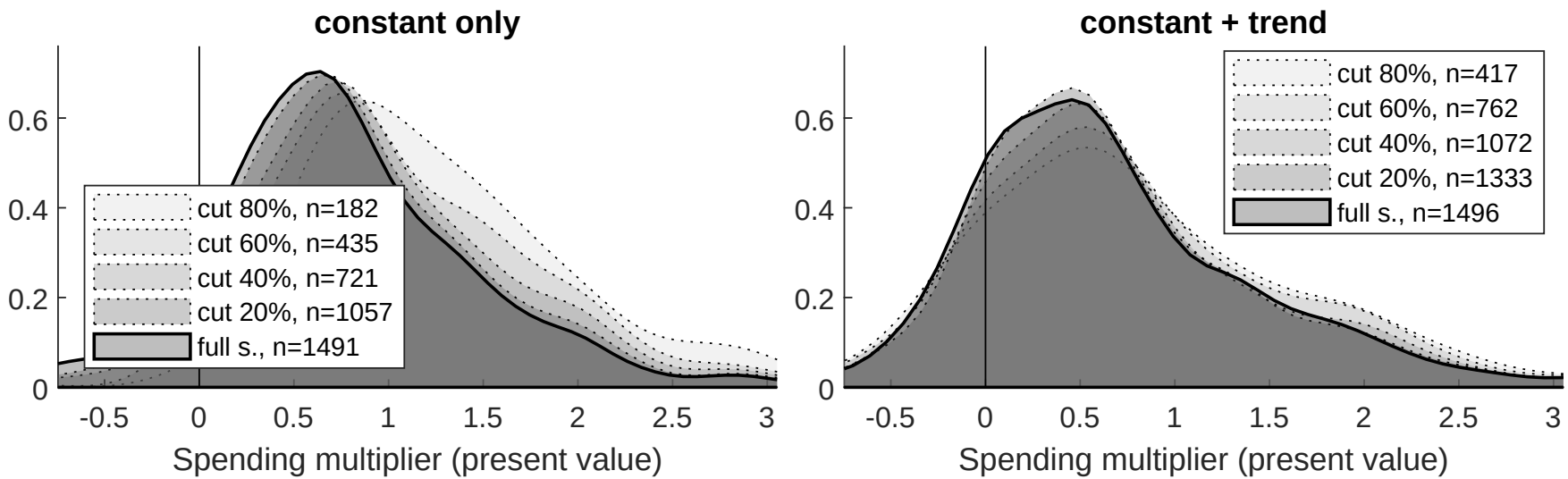
# Multiplier estimates

- Present value multipliers
  - 85.8% of the spending multipliers and 94% of the tax multipliers have the "right" sign
  - 27.9% of the spending multipliers and 43% of the tax multipliers are above unity
- Peak multipliers
  - 96.9% of the spending multipliers and 99.9% of the tax multipliers have the "right" sign
  - 33.7% of the spending multipliers and 9.4% of the tax multipliers are above unity
- The subset of models with best predictive performance tends to imply relatively larger multipliers
- Particular modelling choices lead to large differences in the estimated fiscal multipliers

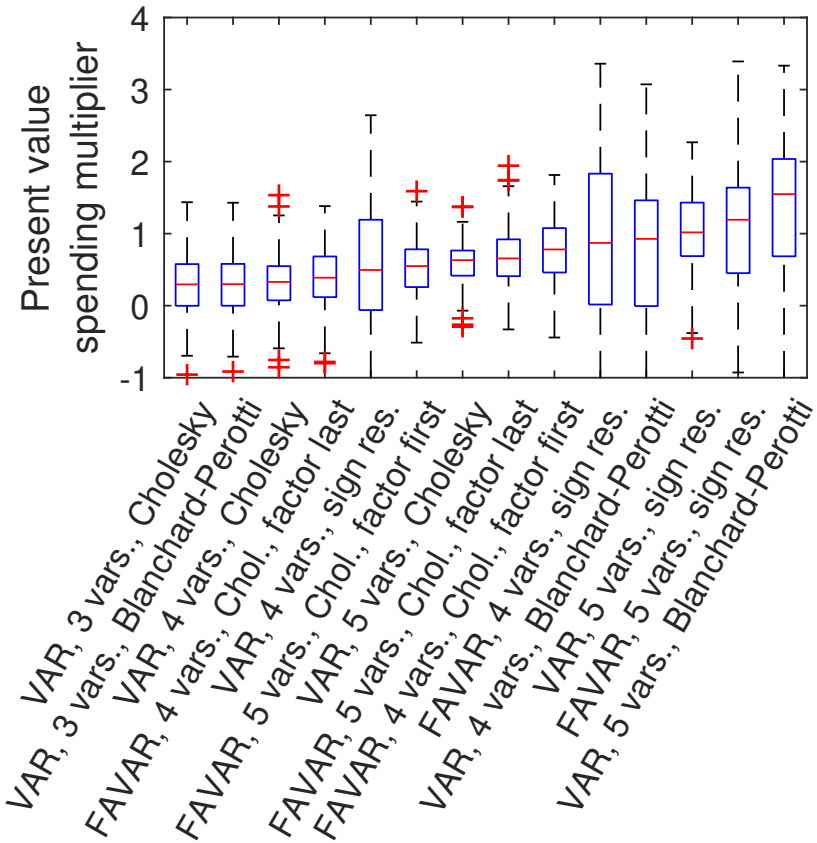
# Multipliers And Deflators

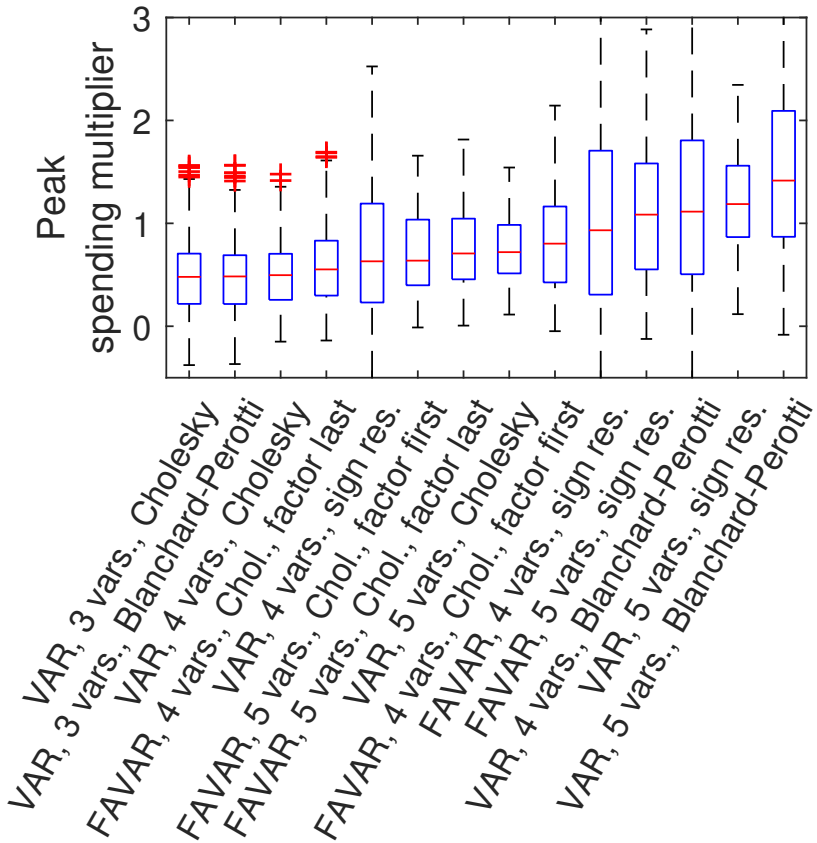


# Multipliers And Trends



# Multipliers And Shock Identification



# Conclusions

- We present a comprehensive framework which allows to assess the effects of different modelling choices on fiscal multiplier estimates for Austria
- Generally, estimates of the peak spending multiplier for Austria tend to be larger than present-value spending multipliers (on average 0.85 vs. 0.68)
- The magnitude of the present-value tax multiplier is relatively high and larger than the peak counterpart (on average -1.12 vs. -0.54)
- Fiscal multipliers tend to increase in absolute value when concentrating on the best models in terms of predictive ability
- Čapek and Crespo Cuaresma (OBES 2019) find a significant increase in spending multipliers since the crisis, independently of the method employed to estimate them: time-varying parameter models?