Persistent effects of autonomous demand expansions

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CONVENTIONAL MACROECONOMIC WISDOM

"Real output in most advanced capitalist economies fluctuates around a rising trend [...] it is part of the usable common core of macroeconomics that the trend movement is predominantly driven by the supply side of the economy (the supply of factors of production and total factor productivity) [...] fluctuations are predominantly driven by aggregate demand impulses [...]." [Solow 1997, p. 230]

According to conventional macroeconomic wisdom [Solow 1997; Taylor 2000; Blinder 2004]:

- aggregate demand (AD) shocks determine **short run** cyclical fluctuations around an **equilibrium GDP** (potential output) and an associated **equilibrium unemployment rate**, determined by supply factors and, in New-Keynesian models, also by institutions;

- potential output and NAIRU are viewed as **attractors** towards which the economy tends to return.

OUR PURPOSE

- Assessing such tendency to **return** to an independently determined potential output after an autonomous demand **expansion**.

- Exploring **persistent** effects of expansions on GDP, inflation, capital stock and labour market variables.

The 'conventional wisdom' has already been challenged by literature and empirical evidence on GDP unit roots and on 'hysteresis'.

The 'real business cycle' interpretation

Cycle and trend are determined by the same factors, i.e., are *supply* determined.

New-Keynesian interpretation

If aggregate demand drives (most) fluctuations [Gali 1999], then *both* cycle and trend would be driven by aggregate demand [Fatàs & Summers 2016]. However very often this stated only for **large** and **negative** demand shocks, implying that subsequent expansions would be inflationary.

OUR RESEARCH AND HYSTERESIS

Our research questions and empirical results have a two-sided relation with 'hysteresis'.

In line

We assess the *persistence* of aggregate demand effects on GDP and other macroeconomic outcomes.

In contrast

We test whether persistence is detected also in instances of **expansions** of aggregate demand, and specifically of its **autonomous components**.

In addition, we look at effects on actual, directly observable variables and NOT on unobservable and indirectly estimated ones such as the NAIRU or potential output.

STEPS

I – Dataset

We build our 'autonomous demand' variable (primary public spending + exports) in a panel of 34 OECD countries between 1960 and 2015.

II – Identification of expansions

We define an expansion episode as a country-year large % increase in autonomous demand ('large' = 1sd above country mean, but we test robustness to different criteria). Thus we identify **94** expansion episodes that we compare with the control group (**1039** country-years not experiencing a large expansion)

III – Empirical estimations

Estimate the impact of these expansions on GDP and other macroeconomic outcomes in the subsequent 10 years, using *local projections* [Jordà 2005].
Two main approaches: dynamic two-way fixed-effects model (analogous to a diff-in-diff) and propensity score-based model which explicitly models selection bias.

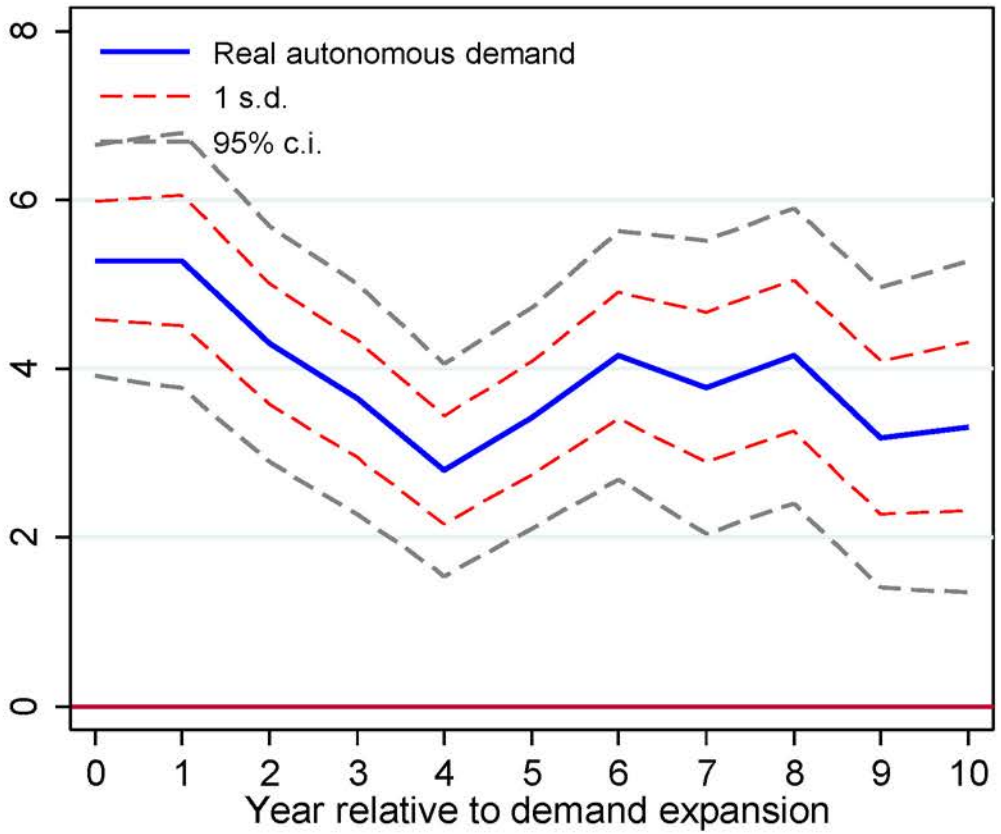
IV – Interpretation of findings

We discuss findings in connection with the literature, we explore the analytical framework consistent with the empirical results and we draw some implications for the interpretation of the long post-2008 stagnation and current policy debates.

AVERAGE AUTONOMOUS DEMAND PATH

This graph displays the behavior of our **autonomous demand** variable during and after an expansionary episode (controlling for country and year fixed effects).

The graph shows that the gap in autonomous demand between the 'expansion units' and the 'control group' is initially about 5% and then stabilizes at 3.5%.



ENDOGENEITY ISSUES

A key challenge: autonomous demand expansions could be partly *endogenous* to macroeconomic conditions

- GDP growth influences autonomous demand (reverse causality);
- other variables may affect both autonomous demand and our outcomes of interest simultaneously (omitted-variables bias).

To assess endogeneity, we consider a number of key observable factors and compare their initial (pre-expansion) values in **expansion** and **control** units.

- We find that countries experiencing expansions are different from control units in terms of lagged macroeconomic conditions, but most of these differences are absorbed by country and year fixed effects.

We thus deal with endogeneity by controlling for **country** and **year fixed effects**. We also estimate **propensity score**-based specifications to further address endogeneity issues.

COVARIATE BALANCE TESTS

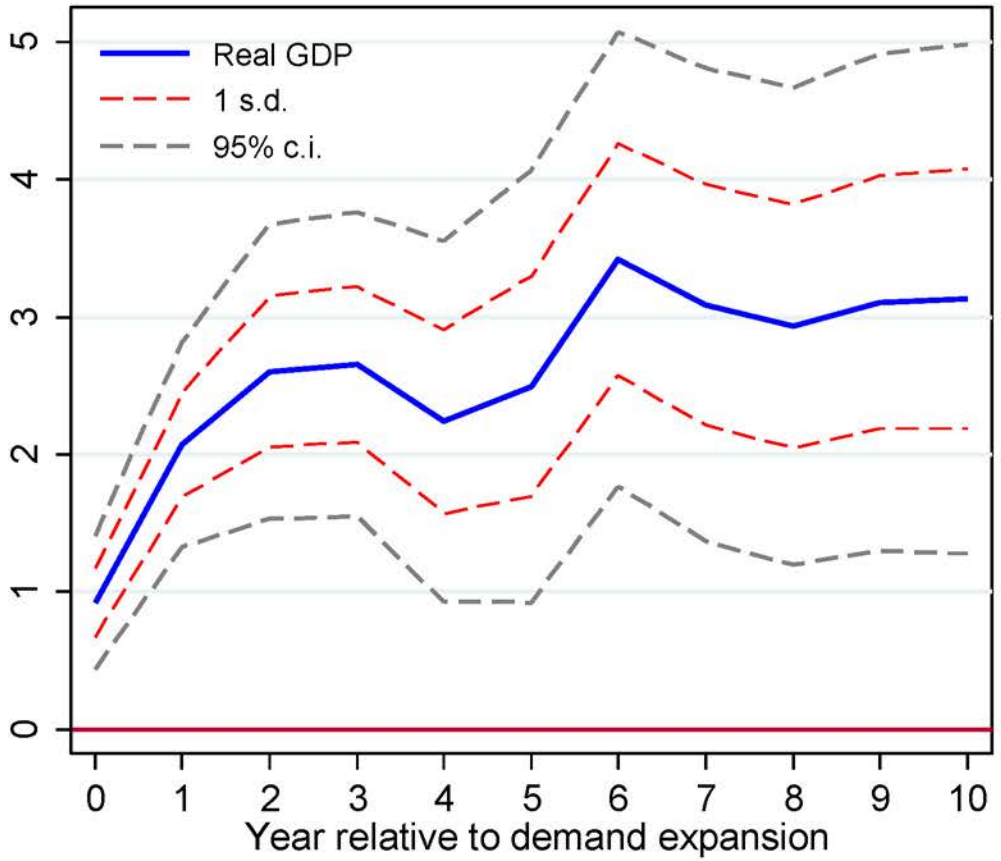
Macroeconomic outcomes at t-1 (previous year)	Differences between **expansion episodes** (94) and **control group** (1039)		
	OLS	**Country FE**	**2-way FE**
Real GDP growth	1.43***	1.34***	-0.01
	(0.38)	(0.38)	(0.34)
Labor productivity growth	1.03***	0.99***	-0.17
	(0.28)	(0.28)	(0.21)
Unemployment rate	-1.44***	-1.05***	0.26
	(0.52)	(0.38)	(0.24)
Real interest rate	-0.79**	-0.84**	0.13
	(0.36)	(0.35)	(0.32)
Participation rate	-0.36	-0.84**	0.06
	(0.59)	(0.34)	(0.20)
Public debt (% of GDP)	-17.07***	-14.56***	-1.06
	(4.85)	(4.47)	(1.21)
CPI inflation rate	0.78	0.88*	0.59
	(0.50)	(0.46)	(0.36)
REER (% change)	-0.97	-0.96*	-1.28**
	(0.59)	(0.56)	(0.56)
Autonomous demand growth (ΔZ)	1.87***	1.76***	0.79**
	(0.31)	(0.27)	(0.36)

EFFECTS ON GDP

Impulse-response function (IRF) through LPs (% points on the vertical axis). We assess the effects of demand expansions by measuring the average GDP variation after an expansion **relative** to a control group of countries that in the same year have not had an expansion (controlling for country & year effects and lags of the dependent variable).

The graph shows the gap in *log(GDP)* in 'treated' and 'control' units between t=0 (the year of expansion) and t+h.

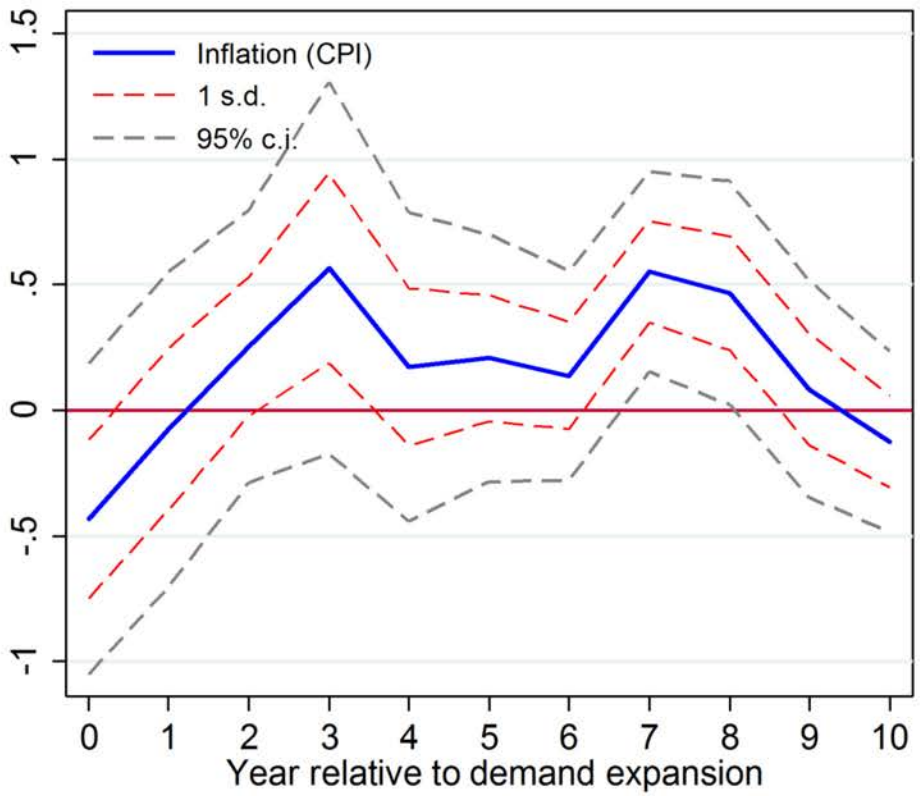
This gap stabilizes at the end of the period with **no sign of mean-reversion**: there is no sign of a 'return' to a path independent of the change in autonomous demand.

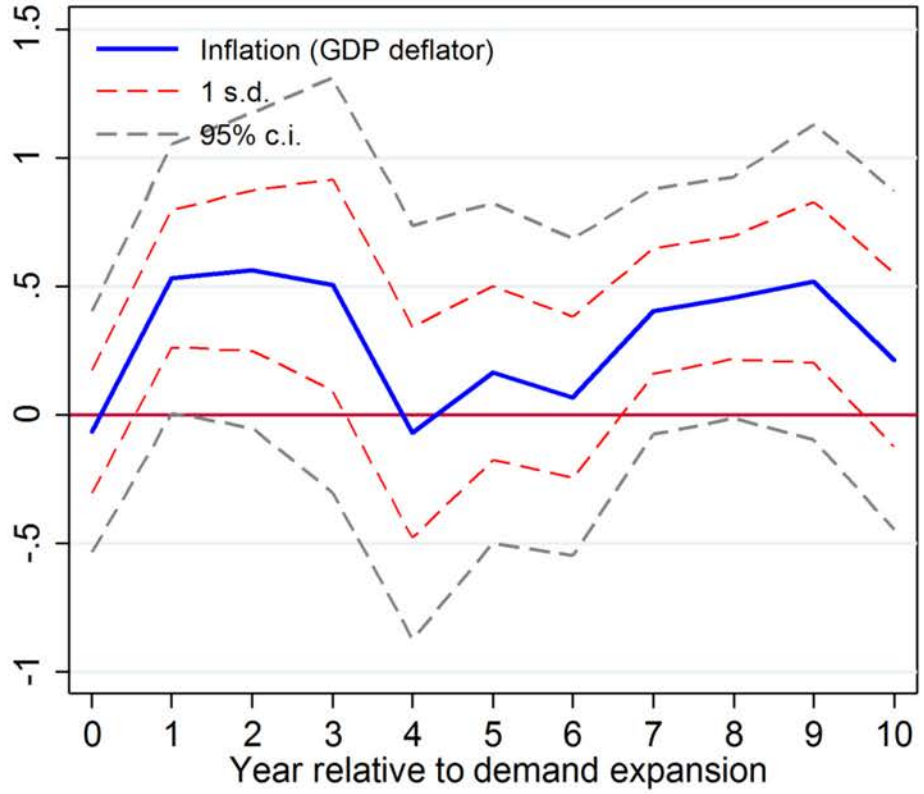


EFFECTS ON INFLATION

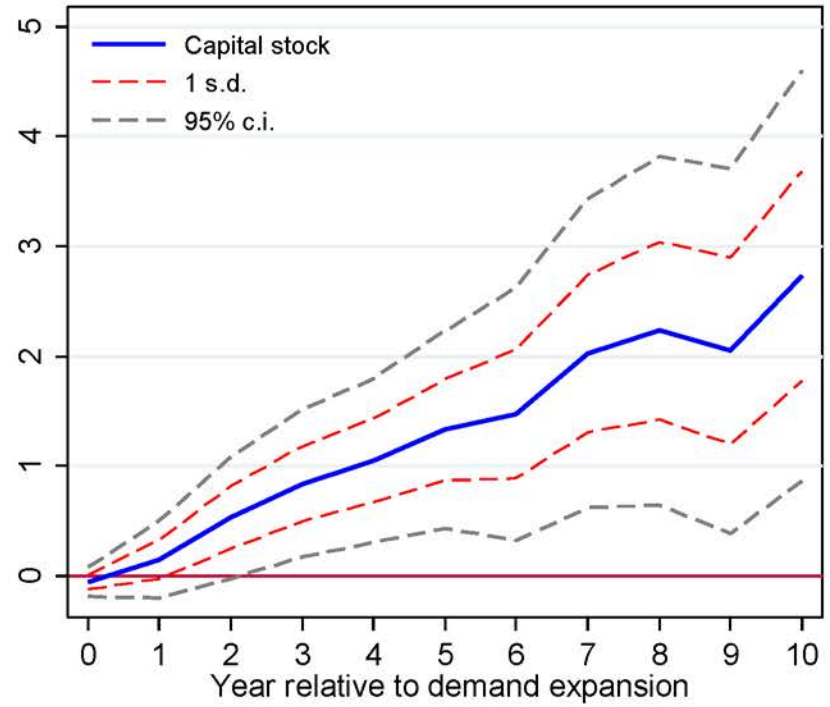
Effects of autonomous demand expansions on inflation:

positive but small, short-lived, statistically non-significant



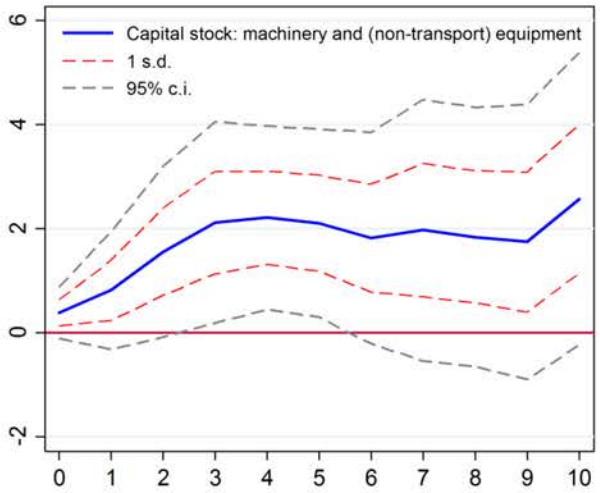


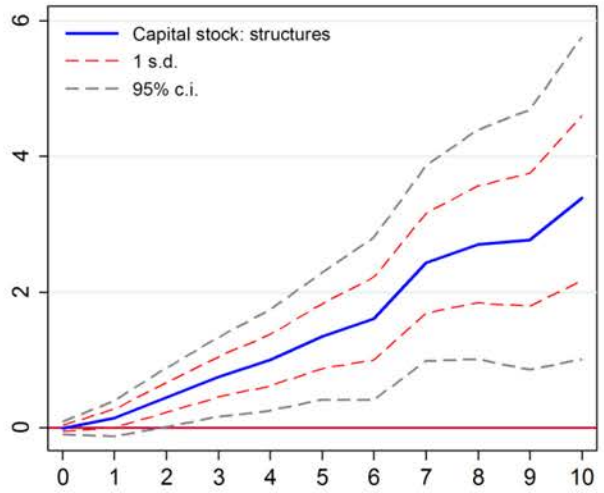
EFFECTS ON CAPITAL STOCK

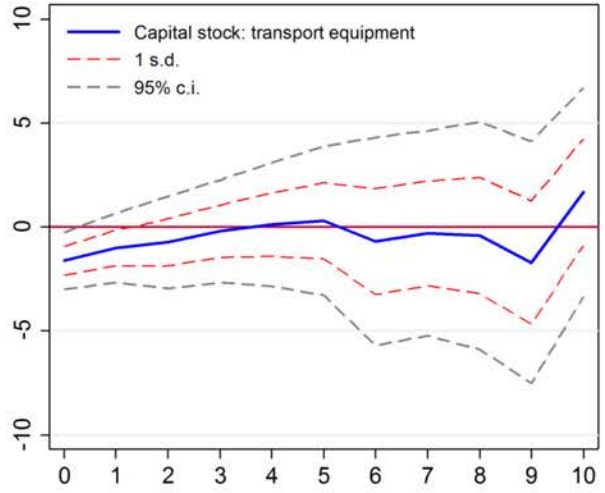


Effects of autonomous demand expansions on capital stock:

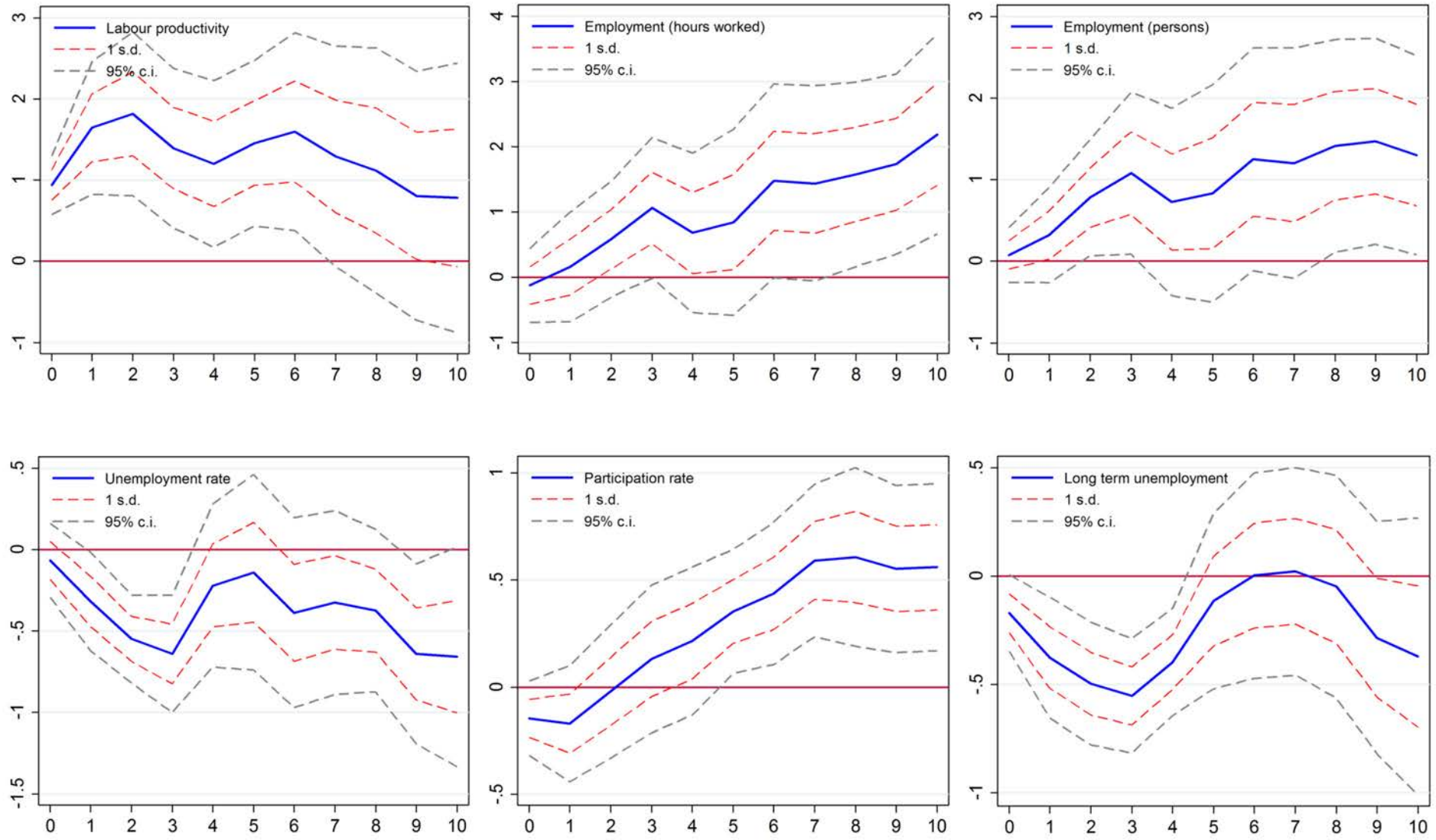
positive, persistent and statistically significant, reflects expansion in structures and machinery.







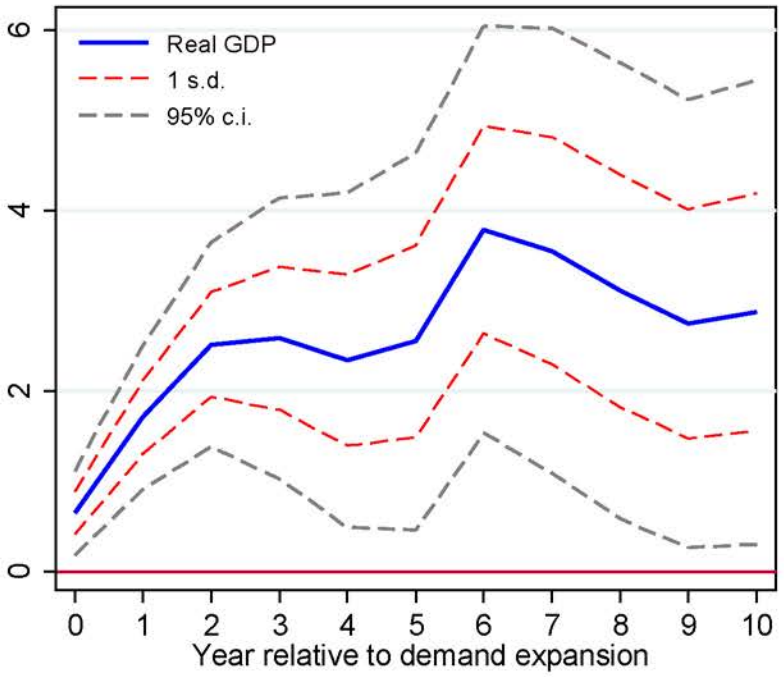
PRODUCTIVITY AND LABOUR MARKET



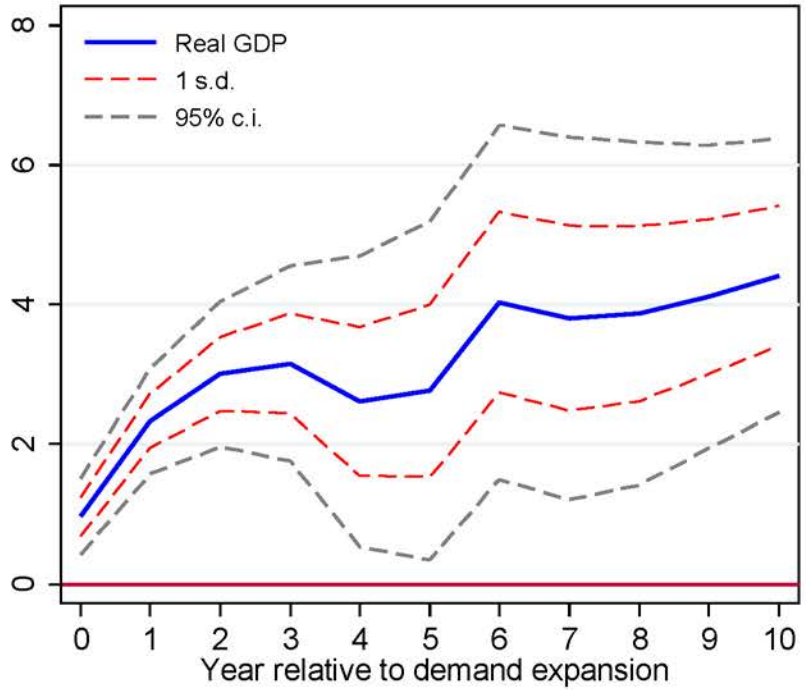
ROBUSTNESS (details in the paper)

1. Additional controls: lagged GDP, productivity and REER dynamics
2. Propensity score-based estimations [Angrist *et al.* 2013]
3. Alternative criteria for selection of expansion episodes
4. Control for time-variable differences in trends in mature and emerging economies
5. Population-weighted estimations
6. Adjusted local projections [Teulings & Zubanov 2010] *(in progress)*

Propensity score-based



Adjusted local projections



OUR RESULTS VIS-À-VIS CURRENT LITERATURE

In contrast with conventional macroeconomic wisdom we find:

- that autonomous demand expansions have persistent effects on GDP (no crowding out and feedback effects on private demand).

In contrast also with some of the hysteresis literature we find:

- that expansions do not generally cause accelerating, nor even stable but high inflation, despite the fall in unemployment and long term unemployment;
- that productivity, capital formation, labour force participation are not independent of aggregate demand also in the case of a positive shock.

Of particular importance for persistence:
the effect of autonomous demand on **capital formation**.

This is in line with already available empirical evidence that the main determinant of investment is (lagged) GDP growth or autonomous demand growth, consistently with the *flexible accelerator* principle, while interest rate plays a small role, if any, in determining investments - see Blanchard [1986], Chirinko [1993], Khotari *et al.* [2014], Girardi & Pariboni [2015; 2016] among others.

A CONSISTENT ANALYTICAL FRAMEWORK

An analytical framework **consistent** with persistent effects of AD changes on GDP needs to be grounded on *three premises*, all of which can be analytically and empirically supported:

1. in any given period, with a given equipment, aggregate demand can differ from the aggregate output that would be forthcoming if the existing fixed capital was utilized in the degree planned by firms;

2. underutilization or overutilization of plants can be persistent enough to induce firms to adjust their capital equipment;

3. even when fix-capital is used in the planned degree, it is possible to increase output simultaneously in the investment goods and consumption goods sectors.

These analytical premises were discussed long ago in Garegnani [1962 (2015); 1978-79], and have stimulated analytical and empirical research on demand-led growth. See Cesaratto & Mongiovi [2015, eds.], Levrero, Palumbo & Stirati [2013, eds.], Girardi & Pariboni [2016] for contributions along these lines.

POLICY IMPLICATIONS (1)

Our results, along with the fairly large recent empirical literature on the persistent effects of recessions and fiscal consolidations, and on the weakness of the relationship between unemployment and inflation [Ball 2009; Blanchard *et al.* 2015; Cerra and Saxena 2009; Haltmeier 2012; Jordà and Taylor 2015; Martin *et al.* 2015; Fatàs and Summers 2016], suggest policy implications at variance with the prevailing official wisdom, particularly in EU institutions.

- The *trade-off* in macroeconomic policy **is overturned**: autonomous demand expansions bring about *persistent* effects on GDP, productivity, capital stock, participation and employment at the cost of an extremely short-lived and moderate inflation.

Implications for the long post-2008 stagnation and policy

Viewed along with the contributions that have shown persistent effects of recessions and fiscal consolidations our results suggest that:

• persistent effects of aggregate demand shocks are *a pervasive phenomenon*, that is not peculiar to the current situation;

• what appears to be peculiar is the **size** of the negative shock, and the combination of a number of concurrent factors – such as high and increasing inequality, austerity policies, private debt deleveraging, trade imbalances – that tend to depress aggregate demand; demand factors can explain the long stagnation;

• fiscal expansion would be a much more effective way out of stagnation than monetary policy *alone* and there is no reason to expect that it would lead to accelerating or even high inflation.

Thank you for your attention.

Persistent effects of autonomous demand expansions

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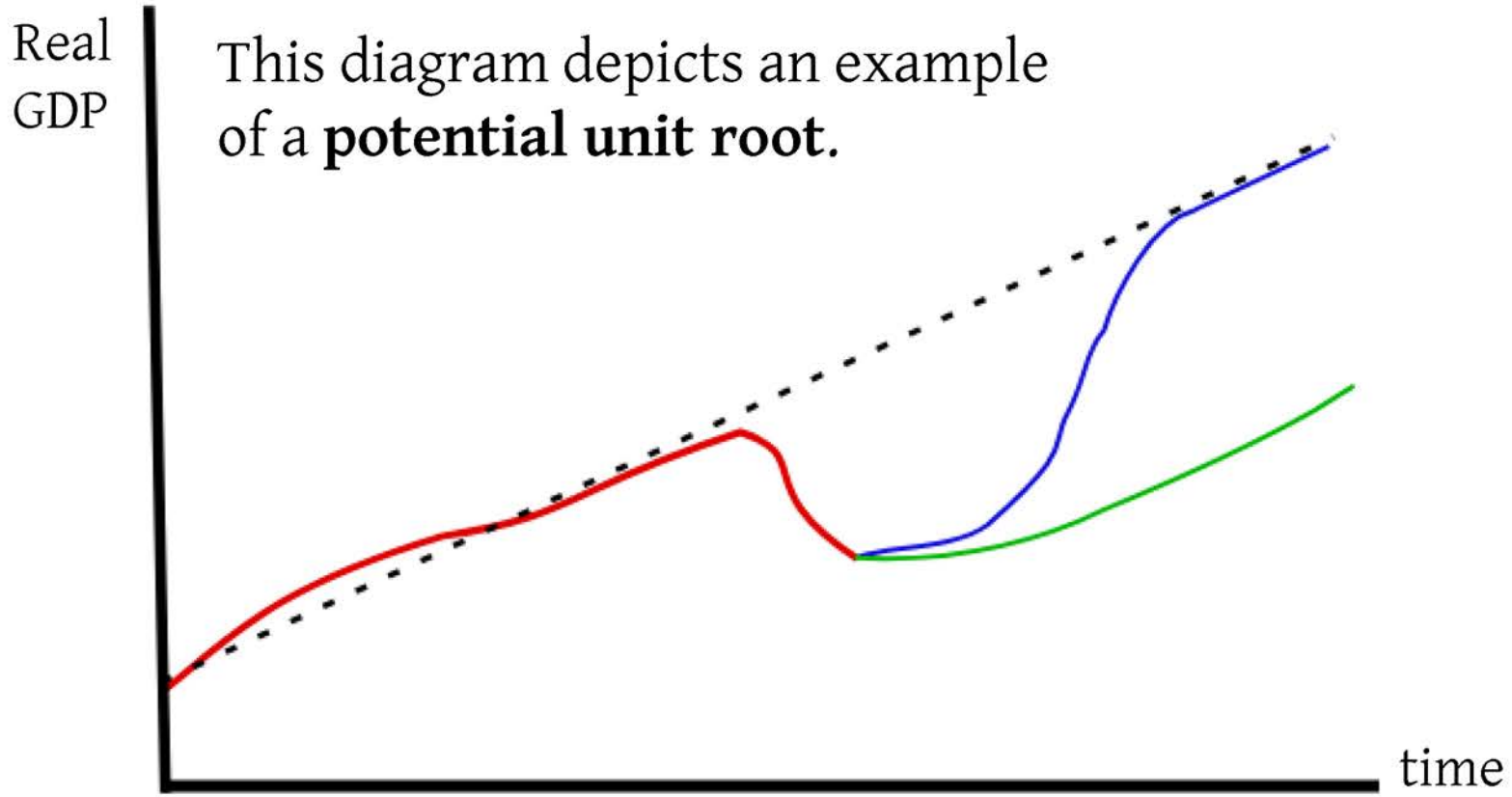
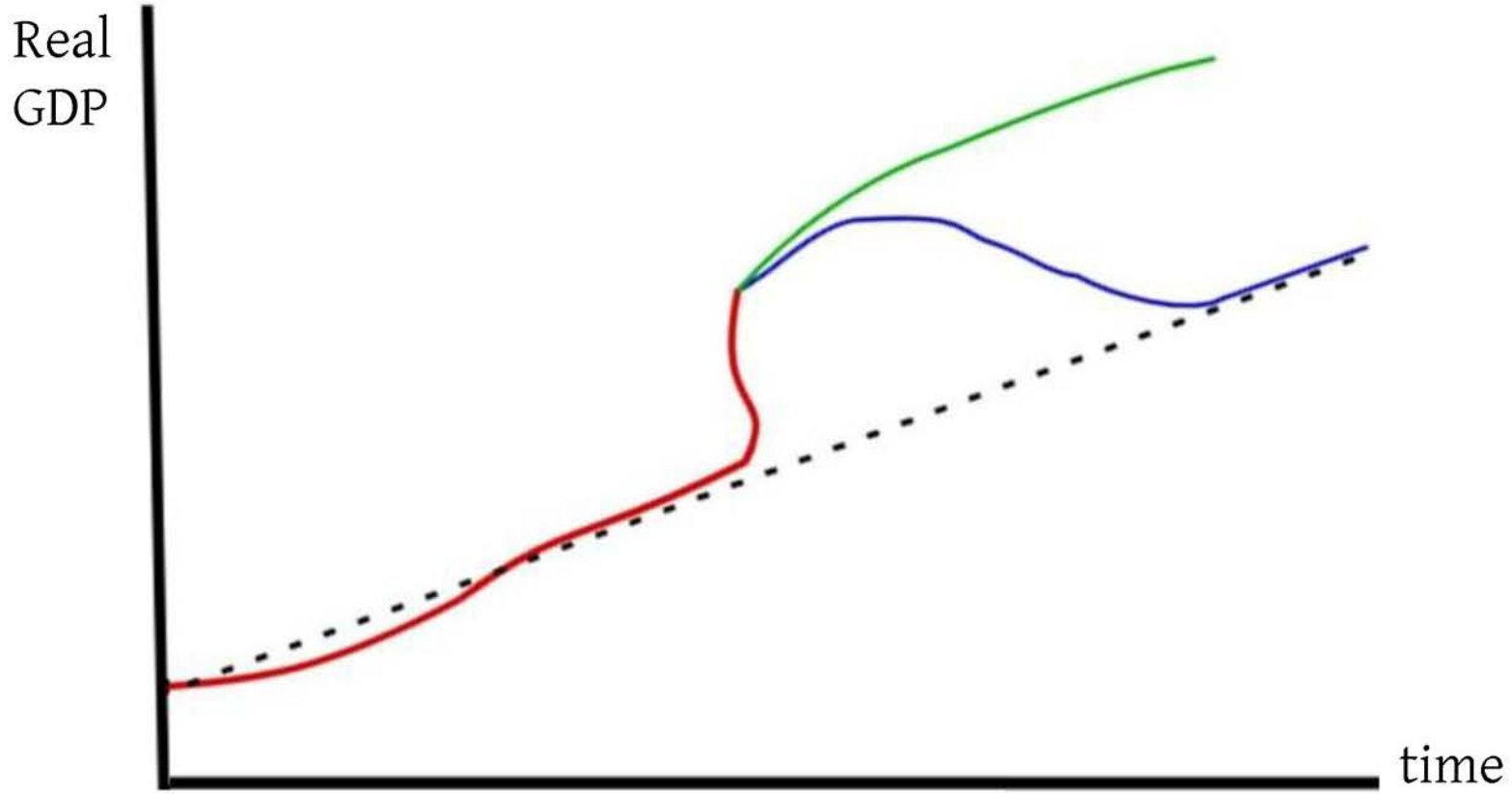
Comments and suggestions are welcome.

Hysteresis and unit roots in GDP



The red line represents an observed drop in output.
The green line shows the path of recovery if the series **has a unit root**.
The blue line shows the recovery if there is **no unit root** (and trend-stationarity).
The blue line returns to meet and follow the dashed trend line while the green line remains permanently below the 'pre-crisis' trend.

A persistent (+) level-effect on GDP



Does a demand boost lead to an output level higher than the pre-expansion trend?

Dataset creation

Our metric of **autonomous demand** (Z) has been built as follows.

AUTONOMOUS DEMAND	
PRIMARY PUBLIC EXPENDITURE General government current disbursement final consumption expenditure social security benefits property income paid other current outlays – gross government interest payments + government fixed capital formation	**TOTAL EXPORTS** of goods and services

Source *OECD.Stat (Economic Outlook No 100 – Nov 2016)* for government expenditure
World Bank (World Development Indicators) for export flows

Autonomous demand change during expansions

Average increase in autonomous demand growth and its components during expansions (t=0)	Differences between **expansion episodes** (94) and **control group** (1039)		
	OLS	**Country FE**	**2-way FE**
Autonomous demand (Z)	6.24***	6.33***	5.04***
	(0.53)	(0.49)	(0.59)
Exports	12.25***	12.59***	8.43***
	(1.22)	(1.15)	(1.40)
Gov' primary current expenditure	4.61***	4.69***	1.35*
	(0.68)	(0.66)	(0.68)
Gov' gross capital formation	5.75***	5.86***	3.70**
	(1.28)	(1.30)	(1.55)

Identification of expansion

We identify expansion episodes based on two criteria.

(c1) Autonomous demand growth must be higher than its country mean μ_i by at least one standard deviation σ_i in the expansion year.

$$\Delta Z_{i,t} > \mu_i(\Delta Z) + \sigma_i(\Delta Z) \qquad \text{(c1)}$$

(c2) Autonomous demand growth must be higher than one half of the country mean in the two years preceding the expansion.

$$\Delta Z_{i,t-1} > \mu_i(\Delta Z)/2 \qquad \Delta Z_{i,t-2} > \mu_i(\Delta Z)/2 \qquad \text{(c2)}$$

Note. When we have two or more years of expansion in a row (e.g., France 1973/1974), we treat them as being part a single episode.

EXPANSIONS = 94 **NO-EXPANSION = 1039**

Empirical estimations

We estimate **impulse-response functions** (IRFs) through **local projections** (LPs) to assess the behaviour of key macroeconomic outcomes (i.e., the average treatment effect) in the decade following an autonomous demand expansion.

Controlling for a full set of *country* and *year fixed effects* is necessary in order to make the **expansion** and **control** units in our sample comparable (exhibiting no significant differences in lagged macroeconomic conditions).

In addition, we always control for lags of the dependent variable (2 lags in the baseline specification, but we check robustness to different number of lags).

We have also carried a number of robustness tests (additional controls) and have estimated different specifications, that can be found in the paper and have confirmed the results presented here, in some instances made them stronger.

Countries in our sample

Country	EXP	NO EXP	ΔZ mean	ΔZ std dev	Country	EXP	NO EXP	ΔZ mean	ΔZ std dev
AUS	3	22	3.64	2.50	KOR	5	39	8.62	6.54
AUT	2	37	2.85	2.71	LAT	1	18	5.27	4.71
BEL	1	42	3.14	3.68	LIT	2	18	6.21	7.83
CAN	4	40	3.24	2.63	LUX	2	23	5.96	5.68
CZE	1	19	4.53	4.68	NED	3	42	3.23	3.41
DEN	5	37	2.74	2.75	NZL	3	24	2.32	2.58
EST	1	19	4.29	7.42	NOR	3	32	2.75	2.25
FIN	7	47	4.00	3.32	POL	3	17	5.47	2.26
FRA	3	45	3.79	2.49	POR	2	34	3.80	3.75
GER	2	22	2.52	3.06	SVK	1	19	5.49	6.36
GRE	1	18	3.07	5.19	SLO	2	18	4.10	4.99
HUN	2	18	4.65	5.55	SPA	3	47	4.84	3.11
ICE	2	32	3.64	3.92	SWE	3	50	3.40	3.08
IRE	2	23	7.31	6.10	SUI	3	22	2.78	3.95
ISR	1	15	3.24	4.00	UK	2	42	2.60	2.97
ITA	5	50	3.45	3.28	USA	7	47	3.70	2.09
JAP	4	48	4.77	4.22	WDE	3	13	2.90	2.21

Total **EXPANSION = 94** **NO-EXPANSION = 1039**

Identified expansions

Country	Year	ΔZ
AUS	1993	6.36
AUS	2000-01	6.86
AUS	2009	8.00
AUS	1979	6.23
AUS	2000	6.41
BEL	1972-74	8.87
CAN	1973-74	7.57
CAN	1978	6.17
CAN	1994	6.26
CAN	2000	7.13
CZE	2005	10.53
DEN	1974	8.88
DEN	1979-81	5.56
DEN	1994	6.22
DEN	2000	7.90
DEN	2006	5.65
EST	2005	12.86
FIN	1964	7.85
FIN	1968-69	9.04
FIN	1972	10.50
FIN	1974	8.79
FIN	1977	8.14
FIN	1979	7.67
FIN	1992	7.48

Country	Year	ΔZ
FRA	1961-65	7.31
FRA	1970	7.33
FRA	1973-74	10.26
GER	2000	6.96
GER	2006	6.31
GRE	1999-00	11.87
HUN	2000	14.14
HUN	2006	15.27
ICE	2001	10.84
ICE	2008	13.87
IRE	1995	13.58
IRE	2000	15.03
ISR	1999-00	10.01
ITA	1962	8.01
ITA	1965	10.37
ITA	1968	10.75
ITA	1974	7.66
ITA	1976	6.99
JAP	1962	12.83
JAP	1964-66	10.65
JAP	1968-69	12.39
JAP	1974	14.12

Country	Year	ΔZ
KOR	1972-73	29.77
KOR	1976	17.19
KOR	1986	15.93
KOR	1998	19.42
KOR	2008	19.91
LAT	2004-05	14.91
LIT	1997	15.55
LIT	2005	15.33
LUX	1998	11.73
LUX	2000	17.32
NED	1973-74	9.44
NED	2000	9.49
NED	2006	6.75
NZL	1999-00	7.43
NZL	2006	6.63
NZL	2008	6.79
NOR	1979-80	6.81
NOR	1989-90	6.07
NOR	1996	5.84
POL	1997	7.77
POL	2003	9.28
POL	2006	10.60
POR	1978-80	9.90
POR	1989	9.54

Country	Year	ΔZ
SVK	2006	15.76
SLO	2000	11.17
SLO	2006	10.01
SPA	1966	10.79
SPA	1968-69	11.51
SPA	1971	11.07
SWE	1963-64	8.19
SWE	1968-69	7.33
SWE	1974	11.99
SUI	2000	8.15
SUI	2007	8.10
SUI	2013	6.75
UK	1973-74	11.54
UK	2006	7.36
USA	1961	6.02
USA	1966-67	7.78
USA	1970	6.81
USA	1974	6.52
USA	1980	6.31
USA	1992	5.87
USA	2008	6.86
WDE	1976	5.14
WDE	1980	5.42
WDE	1990	6.06

Model specification

Two-way fixed effects specification

Eq(1) is the LP specification for estimating **the effect of a treatment** (i.e., an autonomous demand expansion) at different time-horizons:

$$\Delta y_{i,t+h} = \alpha_i^h + \delta_t^h + \beta^h E_{i,t} + \sum_{j=1}^{p} \theta_j^h \Delta y_{t-p} + \sum_{j=1}^{p} \varphi_j^h x_{t-p} + \varepsilon_{i,t+h}$$

for $h = 1,\ldots, n$ (1)

$\Delta y_{i,t+h}$ is the *% change* in the outcome of interest between *t-1* and *t+h* ;

we consider two pre-treatment lags of the dependent variable (*p=2*);

x are control variables used for the robustness analyses (two lagged growth rates of GDP, productivity and REER); even *propensity scores* (IPWRA) are considered;

β^h represents the gap between log(y) in **treated** and **non-treated** observations in the h^{th} year after a Z expansion.

Note: for variables that are stationary we take the absolute value at time *t+h* instead of the change.

Model specification for GDP

In Eq(2) $\Delta GDP_{i,t+h}$ is the *h*-years % *change* in real output between *t-1* and *t+h*, which is equal to $\log(GDP_{t+h}) - \log(GDP_{t-1})$.

$$\Delta GDP_{i,t+h} = \alpha_i^h + \delta_t^h + \beta^h E_{i,t} + \sum_{j=1}^{p} \theta_j^h \Delta GDP_{t-p} + \sum_{j=1}^{p} \varphi_j^h x_{t-p} + \varepsilon_{i,t+h} \quad (2)$$

β^h represents the gap between log(GDP) in **treated** and **non-treated** observations in the *h^{th}-year* after the Z expansion.

We assess the effects of a Z expansion by measuring the average GDP variation after an expansion **relative** to a control group of countries that in the same year have not had an expansion, including a set of variables as controls.

Empirical evidence on investment

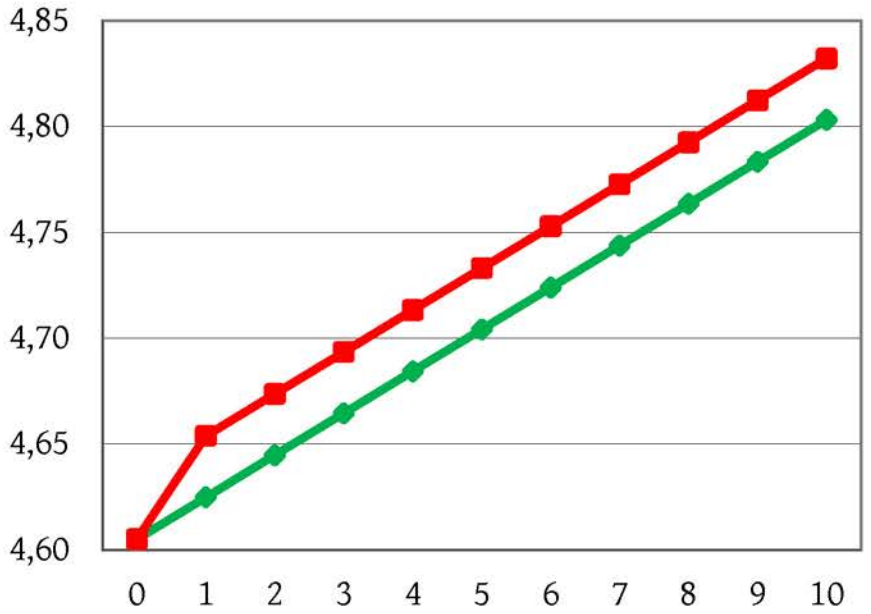
"The discrepancy between theory and empirical work is perhaps nowhere in macroeconomics so obvious as in the case of the aggregate investment function. [...] The theory from which the neoclassical investment function was initially derived implies that one should be able to specify the model equally well whether using only factor prices or using output and the user cost of capital. We all know that this is not the case. [...] It is very hard to make sense of the distributed lag of output on investment. [...]

Finally, **it is well known that to get the user cost to appear at all in the investment equation, one has to display more than the usual amount of econometric ingenuity, resorting most of the time to choosing a specification that simply forces the effect to be there"** [Blanchard 1986]

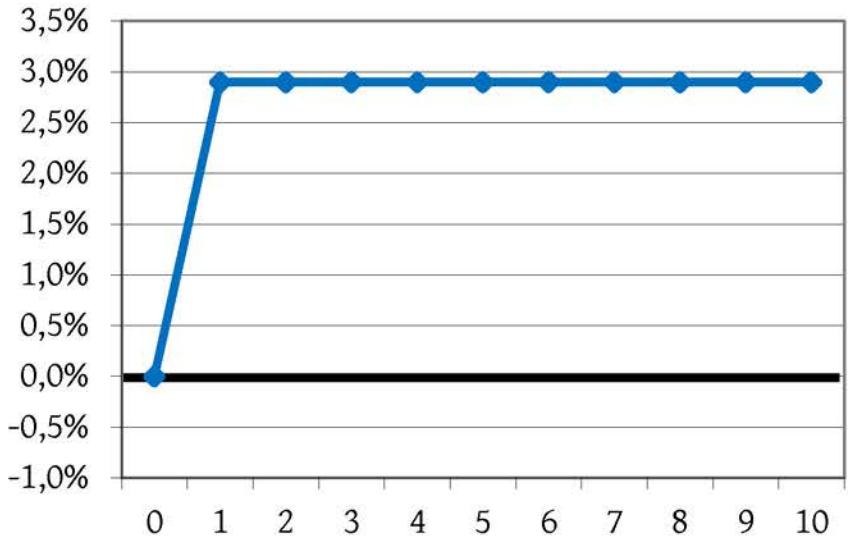
See also Chirinko [1993] and several others.

How to look at our graphs?

A simple numerical example: two countries with the same initial level (t=0) of GDP [log(100) ≈ 4.61]. Let **expansion** country grow at 5% in t+1, while **control** country grows at 2%. After, both countries grow at 2% in each period.



Log(GDP exp) – Log(GDP non-exp)



In **expansion** country GDP grows at the same rate as in **non-treated** country after the expansion, but with a permanent **shift** in its trajectory
→long-term (or persistent) **level effect** on GDP of Z expansion.