GERENCIA DE DIVISIÓN ESTUDIOS
GERENCIA DE INVESTIGACIÓN ECONÓMICA - GERENCIA DE ANÁLISIS INTERNACIONAL

EVOLUCIÓN RECIENTE DE LA INFLACIÓN: ¿ES CHILE DIFERENTE AL RESTO DEL MUNDO?

Autores[1]: Luis Felipe Céspedes
Jorge E. Restrepo
David Moreno

Noviembre de 2009

I. Introducción

A partir de comienzos de la década del noventa Chile comenzó un proceso gradual de reducción de la inflación. La tasa de inflación que a comienzos de la década del noventa se acercó al 30%, cayó consistentemente hasta niveles cercanos al 3% hacia fines de dicha década. Desde entonces y hasta el año 2007, la inflación había oscilado sin grandes variaciones en torno a la meta de 3%. Sin embargo, hacia fines de 2007 Chile experimentó un shock de oferta de gran magnitud radicado fundamentalmente en los componentes energía y alimentos que marca el inicio de un período en el cual la tasa de inflación se alejó significativamente de 3%.

La fuente de dicho shock radicó fundamentalmente en factores externos, asociados a un fuerte incremento en el precio internacional de los bienes denominados *commodities*, en particular el precio del petróleo y de algunos alimentos. Pero también tuvo un componente doméstico asociado a un fuerte incremento en los precios de la energía y frutas y verduras frescas, resultado de una fuerte sequía que afectó al país a partir de la segunda mitad de 2007.

Dicho shock de oferta impulsó la inflación anual de precios al consumidor hasta cerca de 10% en octubre de 2008. Desde entonces, la reducción de precios de materias primas ocasionó una rápida caída en la inflación hasta el punto que la inflación anual observada en los últimos dos meses la inflación anual fue negativa. Cabe resaltar que dicho comportamiento inflacionario ha sido similar cuando se mide la inflación sin incluir precios de energía y alimentos (IPC subyacente).

Este proceso de alza y caída en la inflación ha abierto preguntas respecto a una potencial mayor respuesta de la inflación en Chile a shocks de oferta, una mayor persistencia del fenómeno inflacionario y una mayor volatilidad del mismo. Cabe mencionar que al respecto existen como antecedentes los trabajos de García y Valdés (2005), quienes también hacen un análisis estadístico de la inflación en Chile, Pincheira (2009), quien estudia la persistencia de la inflación en los últimos años y Pedersen (2009), quien analiza

[1] Agradecemos los comentarios y sugerencias de José De Gregorio, Pablo García y Pablo Pincheira

las diferencias entre las inflaciones de Chile y EEUU por componentes del IPC desde el año 2000.

En este trabajo se examinan las fluctuaciones recientes de la inflación IPC e IPC subyacente en Chile desde una perspectiva internacional en términos de tamaño, persistencia, volatilidad y causas. En una primera parte se compara el reciente episodio de alza rápida (boom) y caída rápida (bust) de la inflación para un grupo de 42 economías. Posteriormente se estudia el proceso inflacionario para dichas economías en términos de la persistencia y volatilidad. En particular se busca establecer si la dinámica inflacionaria ha experimentado cambios en años recientes que puedan explicar en alguna medida el fenómeno inflacionario (deflacionario) que experimentaron un grupo de economías en el mundo y en particular la economía chilena. Finalmente se investigan potenciales determinantes de los incrementos y caídas en la inflación subyacente en meses recientes sobre la base de variables tales como el shock de oferta y la brecha producto.

II. Evidencia internacional, descripción de los hechos empíricos

A partir del 2007 cuando los precios de las materias primas aumentaron de manera abrupta, la inflación anual medida con el índice de precios al consumidor comenzó a dar cuenta de incrementos sustanciales en Chile y en una muestra de 43 países obtenida para efectos de comparación (ver gráfico 1).

Este comportamiento también está presente, aunque en menor proporción, cuando se excluyen de la medición de inflación anual los precios de energía y de alimentos o IPC subyacente (al cual denominaremos IPCX para efectos de la presente minuta) (ver gráfico 2). En ambos gráficos se observa que el aumento de la inflación en Chile se encuentra por encima de los aumentos registrados en la mayor parte de la muestra de países.

Con el fin de medir y comparar el tamaño del aumento de la inflación entre los países, se calculó la diferencia entre el punto más alto alcanzado por la inflación IPC e IPCX y el punto mínimo observado durante 2007. Este se denomina episodio de boom de la inflación. Un cálculo similar se hizo para la reducción posterior, al calcular la diferencia entre el punto máximo alcanzado en 2008 y la inflación observada en junio de 2009 (ver cuadro 1). Lo anterior se define como el bust de la inflación.

La evidencia para este grupo de países indica que el aumento de la inflación en Chile fue particularmente elevado en comparación con otras economías de la muestra. Pero así como fue particularmente elevada durante el boom, la caída de la inflación fue particularmente significativa en el período de bust. El anterior comportamiento se mantiene cuando se considera la inflación subyacente (inflación total sin energía y alimentos).

Cabe destacar que el aumento inflacionario chileno ocurrió antes que el aumento inflacionario para la mediana de países. No obstante la caída en la inflación ocurrió de manera más sincronizada (gráficos 1 y 2).

En consecuencia, en el reciente episodio de boom y bust de la inflación, la economía chilena exhibió un comportamiento más marcado en su proceso inflacionario que la mediana de economías bajo análisis.

III. Persistencia y volatilidad de la inflación

Cambios significativos en la persistencia del proceso inflacionario tienen efectos en la transmisión de shocks inflacionarios. En efecto, una mayor persistencia del proceso inflacionario incrementa la vida media de los shocks inflacionarios en la economía, lo que hace más costoso su control. Aunque un análisis detallado de las causas de la persistencia inflacionaria supera los objetivos de esta minuta, se pueden enumerar algunas de las causas de la persistencia: 1. La credibilidad. Así, una mayor persistencia de la inflación puede estar asociada a una mayor predominancia del componente *backward-looking* de la curva de Phillips, y por lo tanto a un menor anclaje de las expectativas inflacionarias o de la meta de inflación. 2. Los mecanismos institucionales de indexación, los cuales una vez establecidos en periodos de alta inflación son muy difíciles de desmontar aun muchos años después de que desaparecen los episodios inflacionarios que los generaron. 3. El tamaño y persistencia de los shocks que recibe la economía. En particular, debido a que Chile es una economía pequeña y muy abierta, cuyo comercio internacional incluye muchas materias primas está especialmente sujeta a shocks de precios de este tipo de productos. 4. La brecha de capacidad de producción, tanto por su tamaño como por el coeficiente con el cual afecta la inflación, pueden tener un efecto en la persistencia inflacionaria, el cual pueden variar de un país a otro. 5. El nivel de la inflación también podría afectar su persistencia. Es decir, la persistencia podría ser endógena y por tanto variable en el tiempo.

Por otra parte, una mayor volatilidad de la inflación puede ser el reflejo de que los agentes ajustan sus precios de manera más frecuente, lo que puede significar que frente a un shock de oferta el traspaso a precios sea más rápido. Lo anterior lleva a que sea crítico para analizar la reciente dinámica inflacionaria, el estudio de la evolución de medidas de persistencia y volatilidad de la inflación.

A. Estimación de la persistencia

Con el objeto de tener una medida de persistencia de la inflación se hicieron varios ejercicios empíricos. En primer lugar, se estimaron regresiones de la inflación mensual tanto desestacionalizada como sin desestacionalizar, con doce de sus propios rezagos AR(12)[2]. La medida de persistencia computada consiste en la suma de los coeficientes obtenidos, sin incluir la constante (Benati, 2008; De Gregorio, 1992 y 2007). La regresión se estimó para dos subperíodos comprendidos entre 1990 y fines de 1998 y entre 1999 y 2009 (ver cuadro 2).

Además de la persistencia se calculó la desviación estándar de los errores de las regresiones y el coeficiente de variación de la inflación, que aquí fue calculado como la desviación

[2] La desestacionalización funciona como un filtro que podría introducir persistencia en la inflación.

estándar incondicional de la serie original de inflación en cada país, normalizada por la respectiva media muestral en cada uno de los periodos (ver cuadro 2).

Los resultados muestran que cuando se compara la persistencia de la inflación mensual en Chile con la del resto de países considerados, ésta se ubica en el 50% de países con mayores niveles de persistencia. Esto es más notorio en el caso de la inflación medida con el IPCX. Asimismo, en el segundo periodo se observa una reducción muy significativa en el nivel del coeficiente de persistencia de la inflación en Chile. Dicha reducción es mayor cuando se usa la inflación subyacente. Lo anterior es consistente con los resultados obtenidos por García y Valdés (2005).

Un patrón de comportamiento similar se encuentra en la desviación estándar de los errores de la regresión. De nuevo, la reducción de la volatilidad de los errores de las regresiones estimadas para Chile es mayor cuando se usa la inflación IPCX (ver cuadro 3). Adicionalmente se encuentra que el coeficiente de variación medido como la desviación estándar de la inflación dividida por la media muestral aumentó en el segundo período (ver cuadro 3). Esto puede ser sólo un reflejo de que en el primer periodo el coeficiente de variación no es una buena medida de volatilidad dado que la inflación presenta una trayectoria claramente decreciente y la media no refleja correctamente lo que ocurrió con la inflación en esos años. Además, la media de la inflación en el segundo periodo fue muy baja. Por tanto, es conveniente realizar cálculos alternativos

Así, con el propósito de tener medidas alternativas de persistencia y del coeficiente de variación, en primer lugar se estimaron regresiones de la inflación mensual desestacionalizada con un solo rezago AR(1) para los dos periodos 1990.01-1998:12 y 1999.01-2009.06 con las series de cada uno de los países (Cuadro 4). Aquí el coeficiente de variación se calculó como: $\left(Desv.Est.Resid./\sqrt{1-\beta^2} \right) \Big/ media \operatorname{var} dep$ [3]. Es decir, corresponde a la volatilidad dividida por la media muestral de la variable dependiente, donde β es el coeficiente de la inflación rezagada un periodo o AR(1).

Los resultados presentados en el cuadro 4 indican que en el caso del IPC, Chile está entre los países con mayor persistencia aunque ésta se redujo en el segundo periodo cuando se estableció plenamente el sistema de metas inflacionarias. En el mismo cuadro se aprecia que el indicador de volatilidad o coeficiente de variación de la inflación IPC también se redujo en el segundo periodo. Cuando se mira la inflación sin energía y alimentos (IPCX) los resultados son similares en el caso de la persistencia. Sin embargo, el coeficiente de variación crece en los últimos años, lo que confirma el resultado obtenido en el cuadro 3.

En segundo lugar, la estimación anterior de un proceso AR(1) para ambas medidas de inflación se hizo también con una muestra móvil de 30 meses, con el propósito de examinar si la persistencia ha fluctuado desde comienzos de los noventa. El coeficiente obtenido para el rezago de la inflación mensual muestra claramente un aumento de la

[3] Hamilton, J. (1994) *Time Series Analysis* Princeton University Press

persistencia inflacionaria en Chile (línea azul) entre el 2002 y el 2004, una disminución entre el 2004 y el 2006 y un aumento significativo a partir de entonces, hasta alcanzar los niveles históricamente altos obtenidos con los datos más recientes (gráficos 3 y 4). Cabe resaltar que este es un fenómeno bastante generalizado en la muestra de países que se incluyó en este análisis.

La persistencia de la inflación, medida con el coeficiente autorregresivo, muestra una dinámica similar cuando se usa el IPCX. Sin embargo, el último aumento de dicha persistencia a partir de 2006 no ha alcanzado los niveles que se observan en el caso de la inflación IPC (Gráfico 4). Asimismo en este caso el aumento de la persistencia en los países de la muestra es menos significativo.

En las medidas de persistencia anteriores no se distinguió si las series de inflación eran estacionarias o si tenían algún orden de integración. Es decir, se supuso implícitamente que todas eran estacionarias. Sin embargo, el orden de integración es importante en la medición de persitencia (De Gregorio, 1993). Por tanto, aquí se usaron series de inflación trimestral para cada uno de los países de la muestra y con el fin de obtener medidas de persistencia se supuso que todas las series eran todas o bien estacionarias o integradas de orden uno. En el caso en que se supone que todas las series son estacionarias, la medida de persistencia consiste en calcular el área bajo la función de respuesta de la variable ante un shock de una unidad. Por tanto, si se trata de un proceso AR(k), el área se obtiene mediante el cálculo $1/\left(1-\sum_{i=1}^{k}\beta_i\right)$, donde los β_i son los coeficientes de los rezagos de la inflación. En el caso en que se supone que las series son integradas de orden uno, la medida de persistencia que se obtiene con el cálculo anterior, consiste una medida del efecto que un shock de una unidad tiene sobre la inflación en el largo plazo. Es decir, el nivel al cual converge la función de impulso respuesta. En ambos casos se estimaron procesos AR(1) y AR(4).

Cuando se supone que la inflación es estacionaria, los resultados confirman que la persistencia de la inflación en Chile disminuyó en el segundo período tanto en términos absolutos como en el ranking de países, sin importar de si se trata de un AR(1) y AR(4). Por el contrario, bajo el supuesto de que la inflación es un proceso I(1) la persistencia aumentó, en niveles y en ranking, en el periodo más reciente que incluye los años 1999-2009. De nuevo, esto ocurre con todos los procesos estimados: AR(1) y AR(4) (ver cuadros 5 y 6).[4]

Que el proceso inflacionario se haya tornado más persistente no necesariamente puede deberse a un cambio en el proceso inflacionario. La forma como se estima la persistencia del proceso inflacionario puede esconder una mayor persistencia del shock. Si el shock es percibido como persistente, es probable que su efecto inicial sobre el nivel de la inflación y sobre su persistencia aumente significativamente. Evidencia parcial indica que efectivamente, en relación con el shock al precio del petróleo, éste fue considerado como muy persistente (ver gráfico 5).

[4] Se estimaron procesos ARMA(1,1) que no se reportan por no ser considerados adecuados para modelar la inflación debido al comportamiento de los errores.

B. Estimación de la volatilidad condicional de la inflación (GARCH)

La evolución de los shocks en términos de su volatilidad se puede obtener mediante la estimación de procesos GARCH, con las dos medidas de inflación de cada uno de los países. Previamente a la estimación de los modelos GARCH se identificó el mejor modelo S-ARIMA posible para cada serie de inflación. Es decir, se encontró el modelo que ajusta mejor la serie incorporando factores estacionales. De esta forma, los errores corresponden a los shocks, propiamente dichos, que recibe la inflación. Una vez identificado el modelo S-ARIMA se estimaron de manera simultánea el modelo S-ARIMA escogido para la inflación y el modelo GARCH para los errores.

Los resultados para la muestra de países y especialmente para Chile son coherentes con la visión de que la volatilidad de los shocks y de la inflación era mayor al inicio de los años noventa desde cuando ésta se redujo de manera significativa. Sin embargo, también se nota en el gráfico un aumento de la volatilidad condicional de las perturbaciones de la inflación en los últimos años, especialmente en el caso del IPC (gráfico 6). La volatilidad condicional de la inflación IPCX ha tenido un comportamiento más estable (suave) con una reducción muy significativa hasta el 2006 pero también muestra algún incremento desde 2007 (gráfico 7).

Cabe resaltar que en los gráficos se aprecia claramente que la volatilidad condicional de la inflación total (IPC) en Chile es menos estable y ha fluctuado con bastante frecuencia por encima de la mediana encontrada para la muestra de países. En contraste, es notable la cercanía de la volatilidad condicional de la inflación sin energía y alimentos o IPCX de Chile con la mediana de dicha volatilidad encontrada para la muestra de países.

IV. Estimación de la Curva de Phillips

Las secciones anteriores muestran que el fenómeno inflacionario chileno reciente ha sido más pronunciado en su magnitud, cuando se compara con una muestra representativa de economías. Incluso, algunos de los indicadores de persistencia muestran un nivel alto relativo a la muestra, especialmente en el primer periodo. No obstante, en el periodo que incluye los últimos diez años su persistencia y volatilidad condicional no distan significativamente de la exhibida por la mediana de las economías bajo análisis, especialmente en el caso de la inflación subyacente.

El comportamiento particular de la inflación chilena a partir de 2007 puede tener distintas causas. La primera es que la magnitud del shock de oferta fue particularmente elevada en el caso de la economía chilena. Lo anterior implica una mayor respuesta de la inflación medida como IPC total y hasta cierta medida también de la inflación subyacente. Adicionalmente, consideraciones de ciclo económico pueden haber explicado la mayor propagación del shock inflacionario en la inflación subyacente[5].

[5] En García y Restrepo (2002) hay un resultado relacionado porque se estima una curva de Phillips y se muestra que el traspaso de tipo de cambio a precios depende de la brecha del producto. Céspedes, Ochoa y Soto (2005) estiman una curva de Phillips neokeynesiana para Chile en la que el traspaso de costos marginales reales a precios también está relacionado con el ciclo y la brecha del producto.

De forma tal de probar dichas hipótesis en esta sección estimamos una pseudo curva de Phillips para el grupo de economías bajo análisis. En particular, en esta sección se estudia la relación entre el aumento (caída) de la inflación subyacente y el shock de oferta que golpeó a cada economía, calculado como la inflación de energía y alimentos, controlando por la brecha del producto y otras variables de interés.

Los eventos inflacionarios se definen de la misma manera que en la sección II. Un episodio de boom inflacionario corresponde a la diferencia en nivel de la inflación entre el punto más alto alcanzado por la inflación IPC e IPCX en el periodo 2008-2009 y el punto mínimo observado durante 2007. Un episodio de bust inflacionario corresponde a la diferencia entre el punto máximo alcanzado en 2008 y la inflación observada en junio de 2009.

A. Aumentos (caídas) de producto e aumentos (reducciones) en la inflación

La primera aproximación a la pregunta consiste en graficar la relación entre cambios en el PIB de los países con los cambios observados en la inflación. Es interesante observar que en el boom que hubo entre 2006 y 2008, dado el aumento observado del PIB, ambas medidas de inflación (IPC e IPCX) aumentaron más en Chile que el promedio encontrado (línea de regresión) para toda la muestra (gráfico 8, columna izquierda). Al mismo tiempo, en la desaceleración de la economía y de la inflación ocurrida a partir de 2008, la inflación en Chile cayó más que el promedio obtenido (línea de regresión) en la muestra de países.

Este resultado puede responder a que la inflación en Chile es más sensible que en otros países a los desarrollos observados en la producción, aunque las estimaciones de corte transversal que se realizan en esta sección no permiten comprobar esta hipótesis. También podría ser el resultado de factores que están omitidos en el gráfico y que empujaron la inflación inicialmente al alza y luego hacia abajo. En particular, es conveniente tener en cuenta los shocks de oferta para saber si este factor fue mayor en Chile que en otros países.

En segundo lugar, cuando se grafica para el conjunto de países la relación entre el cambio de precios de alimentos y el cambio en la inflación subyacente, se encuentra que Chile está ubicado en el patrón medio internacional (gráfico 9, fila superior). El tercer gráfico relaciona los aumentos de la inflación subyacente o IPCX con los cambios observados en los precios de la energía. En este caso los aumentos observados en Chile son superiores a lo que se encuentra en promedio en el resto de países (gráfico 9, fila inferior).

B. Estimación de curva de Phillips de corte transversal

Las relaciones observadas en los gráficos 8 y 9 son útiles en tanto apuntan a que hay relaciones entre la evolución de la inflación y la brecha de capacidad de la economía y la magnitud del shock de oferta (precios de energía y alimentos). Sin embargo, un análisis riguroso de dichas relaciones requiere de la estimación de regresiones que incluya una serie de variables de control y que tenga en cuenta de manera apropiada posibles problemas de endogeneidad o simultaneidad en las variables. Por tanto, el siguiente paso consiste en estimar regresiones de corte transversal (*cross-section*) que permitan determinar cuáles

fueron los determinantes más importantes en el comportamiento de la inflación en el reciente episodio de incremento mundial de precios de la energía y de alimentos.

Las estimaciones se hicieron para el aumento y reducción de la inflación (cuadro 7) y también en forma separada para los episodios de boom y después la desinflación (cuadro 8). En las estimaciones, la variable dependiente es el cambio en la inflación sin energía y alimentos o inflación subyacente y como variables independientes y de control se incluyeron: inflación de oferta π_{ns}, que incluye un promedio ponderado de energía y alimentos, brecha del PIB, $(y-\overline{y})$ en un caso y, alternativamente, el cambio en la brecha del PIB $d(y-\overline{y})$; el cambio del tipo de cambio real $\hat{q}$ (aumentos en esta variable corresponden a una apreciación del tipo de cambio real), apertura comercial, uso de controles de precios y una variable dummy para boom y desinflación.

Los resultados indican que un shock de oferta de 1% incrementa la inflación entre 0.1% y 0.3%. Si se considera que en el episodio inflacionario de boom para la economía chilena, los precios de la energía y alimentos subieron en cerca de un 20%, el aumento en la inflación anual de acuerdo a estas estimaciones habría sido de entre 2% y 6%. Es decir, lo observado en materia de inflación subyacente durante el período del "boom" inflacionario estaría dentro del rango arrojado por estas estimaciones.

Ahora bien, los resultados también indican que el estado de la economía (brecha producto) es un determinante fundamental en el aumento (caída) de la inflación en dicho episodio. En este caso, En este caso, un *shock* de 1% de brecha aumenta la inflación entre 0.19% y 0.33%. Por tanto, dado un shock de oferta, economías en una fase menos dinámica de crecimiento del producto experimentaron un menor incremento en la inflación. En varias de las especificaciones estimadas, el término de interacción entre inflación y brecha de producto resultó positivo y significativo. Es decir, un shock de oferta es más inflacionario si la economía se encuentra en un período de boom económico.

Los resultados presentados indican que la magnitud del shock de oferta que afectó a la economía chilena explicaría de manera importante el fenómeno inflacionario que la economía chilena experimentó. El shock de oferta o, en otras palabras, la inflación de los componentes que no están en el IPCX tuvieron una incidencia en la inflación de Chile mucho mayor que la de otros factores como son brecha, tipo de cambio, interacción entre brecha e inflación de oferta (gráfico 10). Lo anterior es válido tanto en el aumento de la inflación durante el boom como en la reducción o bust. Ciertamente existen otros potenciales candidatos a ser considerados en el análisis econométrico realizado en este trabajo tales como la reacción de política monetaria y no linealidades asociadas a por ejemplo ajustes de precio dependientes del estado de la economía. Estas dimensiones serán dejadas para un trabajo posterior.

V. Conclusiones

La evidencia encontrada para un grupo de 40 países indica que Chile se encuentra entre los países donde el aumento de la inflación a partir de 2007 y su posterior disminución fue más pronunciado. Lo anterior se da tanto en la inflación total (IPC total) como de la inflación subyacente (IPC sin alimentos y energía).

Los resultados muestran que cuando se compara la persistencia de la inflación mensual en Chile con la del resto de países considerados, ésta se ubica en el 50% de países con niveles mayores de persistencia, aunque ésta se redujo en el segundo periodo cuando se estableció plenamente el sistema de metas inflacionarias. Esto es más notorio en el caso de la inflación medida con el IPC subyacente. Cabe señalar que la persistencia de la inflación en Chile aumentó a partir de 2006. Sin embargo, dicho aumento en la persistencia es un fenómeno global.

También se aprecia en los resultados que el indicador de volatilidad o coeficiente de variación de la inflación total IPC se redujo en el periodo comprendido entre 1999 y 2009. Por el contrario, en el caso de la inflación subyacente, es decir sin incluir energía y alimentos, el coeficiente de variación creció en los últimos años. No obstante, cuando se tiene en cuenta que la forma como se estimó la volatilidad del proceso inflacionario puede esconder mayores tamaño y persistencia del shock, se encuentra que en el caso de la inflación subyacente la persistencia y la volatilidad condicional de las perturbaciones estimada con modelos GARCH, no distan significativamente de la exhibida por la mediana de las economías bajo análisis, en el periodo que incluye los últimos diez años.

Al respecto cabe resaltar que se aprecia claramente que la volatilidad condicional de la inflación total (IPC) en Chile es menos estable y ha fluctuado con bastante frecuencia por encima de la mediana encontrada para la muestra de países. En contraste, es notable la cercanía de la volatilidad condicional de la inflación sin energía y alimentos o IPCX de Chile con la mediana de dicha volatilidad encontrada para la muestra de países.

Al considerar solo factores de demanda como determinantes de la inflación se encuentra que la inflación total y la subyacente aumentaron más que lo que indicaría el cambio en las condiciones de demanda. No obstante, cuando se consideran factores de oferta, se encuentra que en Chile que la relación entre el cambio de precios de alimentos y el cambio en la inflación subyacente es similar al patrón internacional. Por el contrario, en el análisis de la relación entre cambios de precios de la energía y cambios en la inflación subyacente, se observa que los aumentos de la inflación subyacente son superiores a lo que se encuentra en el resto de países. Sin embargo, un análisis más profundo requiere de la estimación de regresiones con variables de control y que tengan en cuenta de manera apropiada posibles problemas de simultaneidad en las variables.

La inflación en Chile parece ser especialmente sensible al shock de oferta asociado a los costos del petróleo y de la energía en general. Además, la estimación de la curva de Phillips con la muestra de países confirma también que el estado del ciclo económico en el momento del shock influye en la transmisión de éste.

Bibliografía

Benati, L (2008) “Investigating inflation persistence across monetary regimes” European Central Bank Working Paper Series 851.

Céspedes, L.F., M. Ochoa y C. Soto (2005) The new Keynesian Phillips curve in an emerging market economy: the case of Chile. Banco Central de Chile, Documento de Trabajo 355.

De Gregorio, J. (1992) “The persistence of inflation and gradual stabilizations” International Monetary Fund WP/92/19.

De Gregorio, J. (2007) “Defining inflation targets, the policy horizon and the output-inflation tradeoff” Banco Central de Chile, Documento de Trabajo No.415.

García, P y R. Valdés (2005) “The Inflation Process in Chile: Changes and Stability” Mimeo, Banco Central de Chile.

García, C. y J.E. Restrepo (2002) “Price inflation and exchange rate pass-through in Chile” Money Affairs 26(1).

Hamilton, J. (1994) *Time Series Análisis* Princeton University Press

Pedersen, M. (2009) “¿Por qué en el 2008 la inflación chilena fue mayor que la estadounidense?” Banco Central de Chile, mimeo.

Pincheira, P. (2009), ´La dinámica de la persistencia inflacionaria en Chile’, *Economia Chilena*, 12(1): 97-104.

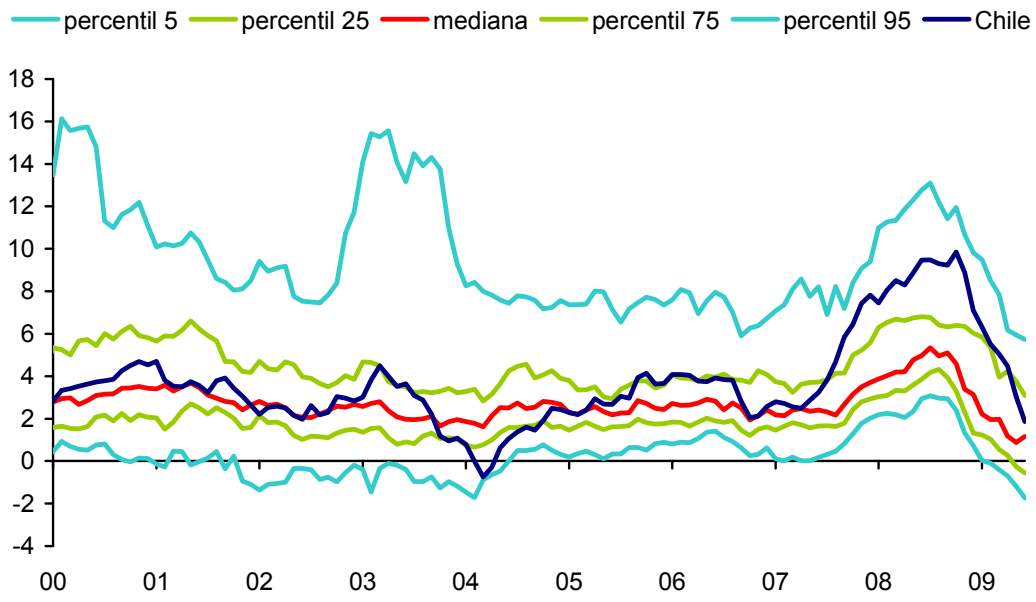
Anexo

Descripción de las variables

		Cálculo	
Símbolo	Definición	Boom	Bust
π(s)	Inflación sin alimentos ni energía	inflación anual máxima en 2008 menos inflación anual mínima en 2007	inflación anual en junio de 2009 menos inflación anual máxima en 2008
π(f)	Inflación de alimentos	inflación anual máxima en 2008 menos inflación anual mínima en 2007	inflación anual en junio de 2009 menos inflación anual máxima en 2008
π(e)	Inflación de energía	inflación anual máxima en 2008 menos inflación anual mínima en 2007	inflación anual en junio de 2009 menos inflación anual máxima en 2008
(y-ÿ)	brecha del PIB	brecha máxima entre 2007 y 2008	brecha en 2009q01
d_tcr	apreciación del tipo de cambio real	valor máximo en 2008 menos valor mínimo en 2007	valor en junio de 2009 menos valor máximo en 2008
openness	Libertad para comerciar internacionalmente (Catho Institute)	--	--
price_control	Controles de precios (Catho Institute)	--	--

Gráfico 1

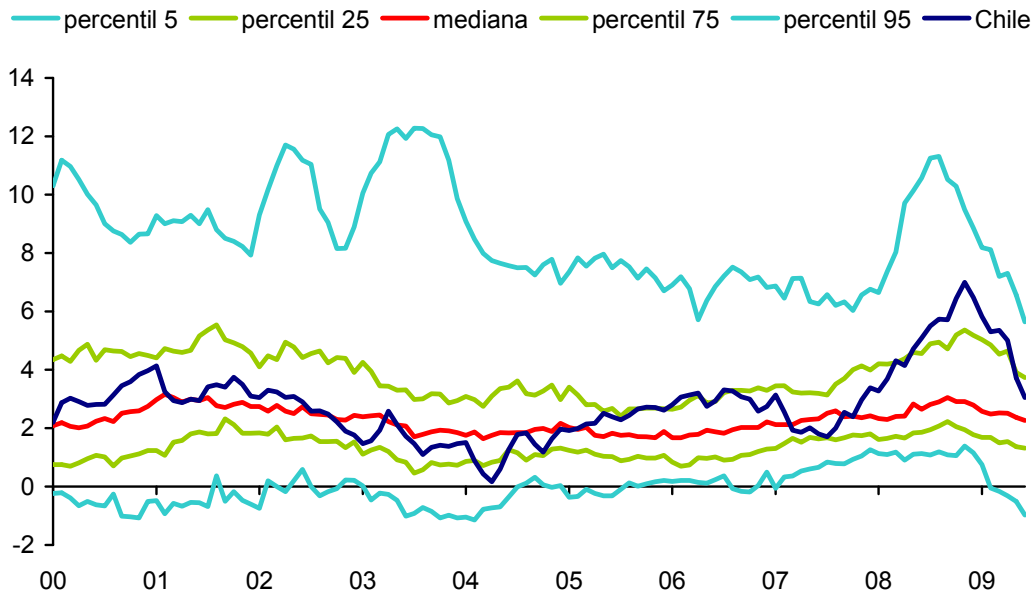
Inflación anual del IPC
(porcentaje)



Fuente: Elaboración propia en base a OECD, Eurostat y Oficinas Estadísticas Nacionales.

Gráfico 2

Inflación anual del IPC sin alimentos ni energía
(porcentaje)



Fuente: Elaboración propia en base a OECD, Eurostat y Oficinas Estadísticas Nacionales.

Cuadro 1

Cambio en la tasa de inflación anual
(puntos porcentuales)

Inflación del IPC total				Inflación del IPC subyacente			
Boom*		Bust**		Boom*		Bust**	
Iceland	14.66	Mexico	-0.79	Iceland	11.18	Romania	1.47
Latvia	10.61	Poland	-0.80	Latvia	8.09	Norway	0.79
Bulgaria	10.34	Brazil	-1.61	Bulgaria	7.29	France	0.48
Lithuania	8.63	Netherlands	-1.80	Lithuania	6.38	Canada	0.25
Chile	7.37	Norway	-2.03	Israel	6.00	Belgium	0.13
Singapore	7.31	Slovak Repub	-2.95	Singapore	5.56	Poland	0.11
Perú	6.83	Denmark	-3.13	Chile	5.29	Brazil	-0.08
Israel	6.81	Nueva Zeland	-3.19	Czech Repub	4.68	Denmark	-0.13
Estonia	6.73	Germany	-3.19	Hong Kong	4.26	Germany	-0.17
Czech Repub	6.15	Romania	-3.25	Perú	3.93	Colombia	-0.23
Taiwan	6.13	United Kingdc	-3.41	Slovak Repub	3.11	Mexico	-0.27
Norway	5.80	Hungary	-3.45	Turkey	3.00	Slovak Repub	-0.34
Hong Kong	5.54	Australia	-3.52	Taiwan	2.93	Nueva Zeland	-0.45
Romania	5.37	Italy	-3.57	Slovenia	2.71	Perú	-0.51
Turkey	5.17	Perú	-3.69	Estonia	2.69	Netherlands	-0.55
Slovenia	4.86	Canada	-3.75	Romania	2.25	Switzerland	-0.58
Belgium	4.79	Austria	-3.86	Korea	2.18	Hungary	-0.61
Korea	4.22	Korea	-3.91	Brazil	2.03	United Kingdc	-0.70
United States	3.63	Switzerland	-4.03	Mexico	1.96	Austria	-0.72
United Kingdc	3.50	Japan	-4.06	Poland	1.95	United States	-0.81
Brazil	3.45	France	-4.10	Australia	1.77	Japan	-0.91
Poland	3.31	Colombia	-4.12	Denmark	1.68	Luxembourg	-1.03
Nueva Zeland	3.29	Greece	-4.38	Switzerland	1.34	Greece	-1.23
Denmark	3.24	Finland	-4.79	Italy	1.31	Korea	-1.41
Colombia	3.23	Portugal	-4.95	Austria	1.23	Italy	-1.51
Australia	3.11	Sweden	-5.00	Norway	1.10	Spain	-1.65
Spain	3.10	Luxembourg	-5.15	Netherlands	1.08	Australia	-1.80
Switzerland	3.09	Iceland	-5.96	Belgium	1.00	Portugal	-1.88
Slovak Repub	3.08	Spain	-6.27	Greece	1.00	Slovenia	-2.01
Luxembourg	3.01	Turkey	-6.33	Finland	0.97	Finland	-2.70
Mexico	2.79	Czech Repub	-6.39	United Kingdc	0.87	Czech Repub	-3.42
Sweden	2.71	Slovenia	-6.64	Japan	0.73	Hong Kong	-3.53
France	2.56	Belgium	-7.02	Colombia	0.71	Sweden	-3.54
Finland	2.54	United States	-7.03	Sweden	0.68	Taiwan	-3.86
Italy	2.54	Hong Kong	-7.24	Luxembourg	0.61	Chile	-3.95
Japan	2.50	Taiwan	-7.78	Nueva Zeland	0.60	Turkey	-4.30
Greece	2.39	Chile	-7.99	United States	0.41	Lithuania	-4.85
Canada	2.38	Singapore	-8.04	Portugal	0.30	Iceland	-4.92
Austria	2.27	Lithuania	-8.78	Spain	0.25	Estonia	-4.94
Netherlands	2.12	Ireland	-10.40	France	0.18	Singapore	-5.52
Germany	1.59	Bulgaria	-12.11	Canada	0.14	Bulgaria	-6.15
Portugal	1.31	Estonia	-12.39	Germany	0.11	Ireland	-9.11
Hungary	0.76	Latvia	-14.59	Ireland	0.07	Latvia	-9.26
Ireland	0.40	Israel	n.a.	Hungary	-0.27	Israel	n.a.

* Boom: diferencia entre la inflación anual mínima en 2007 y la máxima en 2008.
** Bust: diferencia entre la inflación de junio de 2009 y la máxima en 2008.
Fuente: Elaboración propia en base a OECD, Eurostat y Oficinas Estadísticas Nacionales.

Cuadro 2
Estadísticos obtenidos con la inflación mensual del IPC total con AR(12)

Suma de coef.

1991.01-1998.12		1999.1-2009.6	
Hong Kong	1.36	Romania	0.95
Brazil	0.94	Turkey	0.91
Austria	0.94	Poland	0.89
Luxembourg	0.92	Brazil	0.77
Greece	0.90	Latvia	0.76
Italy	0.89	Hungary	0.75
Hungary	0.88	Mexico	0.74
Perú	0.88	Lithuania	0.72
Switzerland	0.86	Slovenia	0.72
Spain	0.85	Ireland	0.70
Mexico	0.83	Colombia	0.65
Colombia	0.80	Hong Kong	0.64
Portugal	0.79	Netherlands	0.58
Germany	0.74	Chile	0.54
Chile	0.74	Iceland	0.53
Poland	0.74	Finland	0.51
France	0.71	Estonia	0.51
United Kingdom	0.70	Perú	0.51
Slovenia	0.70	Slovak Republic	0.45
Sweden	0.66	Portugal	0.43
Finland	0.61	Czech Republic	0.40
Israel	0.61	Israel	0.37
Singapore	0.53	United Kingdom	0.36
Slovak Republic	0.50	Singapore	0.35
Iceland	0.49	Austria	0.32
Belgium	0.48	Sweden	0.30
United States	0.42	Bulgaria	0.21
Canada	0.38	Switzerland	0.19
Ireland	0.28	Germany	0.18
Turkey	0.27	Spain	0.16
Netherlands	0.24	Denmark	0.10
Czech Republic	0.20	France	0.08
Japan	0.18	Belgium	0.07
Korea	0.18	Korea	0.05
Norway	-0.12	Japan	0.05
Denmark	-0.24	Italy	0.01
Taiwan	-1.06	Greece	-0.16
Estonia	--	Norway	-0.26
Bulgaria	--	Luxembourg	-0.28
Lithuania	--	United States	-0.31
Latvia	--	Taiwan	-0.37
Romania	--	Canada	-0.86

Desv.est. de los errores

1991.01-1998.12		1999.1-2009.6	
Brazil	4.89%	Turkey	0.91%
Turkey	2.12%	Slovak Republic	0.74%
Czech Republic	1.02%	Romania	0.70%
Poland	1.00%	Bulgaria	0.64%
Slovak Republic	1.00%	Taiwan	0.63%
Taiwan	0.74%	Hong Kong	0.51%
Perú	0.62%	Lithuania	0.43%
Mexico	0.60%	Iceland	0.42%
Slovenia	0.60%	Estonia	0.40%
Hungary	0.59%	Norway	0.38%
Israel	0.49%	Latvia	0.36%
Sweden	0.46%	Israel	0.35%
Korea	0.38%	Singapore	0.34%
Hong Kong	0.37%	Slovenia	0.33%
Chile	0.37%	Korea	0.31%
Greece	0.34%	Canada	0.30%
Canada	0.31%	Czech Republic	0.29%
Colombia	0.30%	Hungary	0.27%
Japan	0.30%	United States	0.27%
Iceland	0.28%	Sweden	0.26%
United Kingdom	0.25%	Luxembourg	0.26%
Germany	0.25%	Belgium	0.25%
Finland	0.21%	Chile	0.25%
Singapore	0.21%	Finland	0.22%
Portugal	0.20%	Brazil	0.21%
Belgium	0.17%	Ireland	0.21%
Netherlands	0.17%	Perú	0.20%
Norway	0.16%	Colombia	0.20%
Ireland	0.15%	Japan	0.19%
Spain	0.13%	Germany	0.18%
France	0.13%	Greece	0.18%
Luxembourg	0.12%	France	0.18%
Switzerland	0.12%	Netherlands	0.18%
Denmark	0.12%	Portugal	0.16%
Austria	0.12%	Denmark	0.16%
Italy	0.11%	Austria	0.16%
United States	0.10%	Mexico	0.15%
Estonia	--	United Kingdom	0.15%
Bulgaria	--	Poland	0.14%
Lithuania	--	Spain	0.14%
Latvia	--	Switzerland	0.11%
Romania	--	Italy	0.10%

Coeficiente de variación

1991.01-1998.12		1999.1-2009.6	
Japan	3.40	Taiwan	9.30
Taiwan	3.36	Singapore	3.22
Sweden	2.59	Israel	2.64
Canada	2.18	Norway	2.26
Finland	1.58	Sweden	2.13
Singapore	1.54	Lithuania	1.99
Slovenia	1.43	Canada	1.74
Iceland	1.40	Switzerland	1.73
Perú	1.22	Finland	1.63
Switzerland	1.20	Belgium	1.57
Slovak Republic	1.20	Slovak Republic	1.52
Germany	1.18	United States	1.51
Brazil	1.18	Germany	1.44
United Kingdom	1.18	Ireland	1.37
Belgium	1.17	France	1.36
Czech Republic	1.14	Luxembourg	1.35
France	0.99	Czech Republic	1.35
Norway	0.96	Estonia	1.33
Korea	0.94	Korea	1.27
Ireland	0.87	Bulgaria	1.21
Hong Kong	0.84	Perú	1.14
Luxembourg	0.83	Chile	1.11
Netherlands	0.80	United Kingdom	1.11
Mexico	0.75	Austria	1.05
Austria	0.74	Iceland	1.04
Denmark	0.72	Latvia	1.03
Poland	0.72	Netherlands	1.00
Israel	0.66	Turkey	0.96
Portugal	0.65	Slovenia	0.95
Chile	0.62	Romania	0.93
Greece	0.61	Portugal	0.93
Spain	0.55	Denmark	0.90
Italy	0.50	Poland	0.84
United States	0.48	Spain	0.77
Hungary	0.48	Greece	0.76
Turkey	0.42	Italy	0.64
Colombia	0.23	Hungary	0.61
Estonia	--	Brazil	0.59
Bulgaria	--	Mexico	0.55
Lithuania	--	Colombia	0.46
Latvia	--	Japan	-7.46
Romania	--	Hong Kong	-19.02

Cuadro 2 A
Estadísticos obtenidos con la inflación mensual del IPC total sin desestacionalizar con AR(12)

Suma de coef.

1991.01-1998.12		1999.1-2009.6	
Hong Kong	1.47	Ireland	1.03
Hungary	0.96	Romania	0.95
Brazil	0.94	Turkey	0.91
Italy	0.92	Poland	0.82
Austria	0.85	Latvia	0.82
Spain	0.84	Portugal	0.78
Mexico	0.82	Lithuania	0.75
Switzerland	0.81	Slovenia	0.75
Perú	0.78	Hungary	0.73
Greece	0.78	Brazil	0.66
Germany	0.77	Mexico	0.65
France	0.76	Hong Kong	0.61
Colombia	0.73	Iceland	0.60
Slovenia	0.70	Chile	0.59
Chile	0.69	Netherlands	0.56
Luxembourg	0.68	Estonia	0.56
Portugal	0.67	Slovak Republic	0.49
Poland	0.65	Perú	0.49
Israel	0.62	Finland	0.49
Sweden	0.61	Colombia	0.45
United Kingdom	0.59	Israel	0.41
Finland	0.57	United Kingdom	0.40
Singapore	0.52	Czech Republic	0.36
Iceland	0.51	Singapore	0.30
Belgium	0.43	Bulgaria	0.29
Slovak Republic	0.42	Spain	0.28
Canada	0.40	Italy	0.27
Korea	0.29	Austria	0.22
Turkey	0.28	Sweden	0.17
United States	0.26	Denmark	0.10
Netherlands	0.15	Belgium	0.07
Czech Republic	0.13	Japan	0.07
Japan	0.09	France	0.04
Ireland	0.06	Germany	-0.05
Estonia	0.00	Korea	-0.05
Bulgaria	0.00	Greece	-0.10
Lithuania	0.00	United States	-0.22
Latvia	0.00	Norway	-0.24
Romania	0.00	Switzerland	-0.43
Norway	-0.25	Luxembourg	-0.61
Denmark	-0.43	Taiwan	-0.79
Taiwan	-1.63	Canada	-1.02

Desv.est. de los errores

1991.01-1998.12		1999.1-2009.6	
Brazil	4.85%	Turkey	1.10%
Turkey	2.47%	Slovak Republic	0.86%
Czech Republic	1.20%	Bulgaria	0.85%
Slovak Republic	1.11%	Taiwan	0.79%
Poland	1.05%	Romania	0.70%
Taiwan	0.92%	Hong Kong	0.56%
Hungary	0.92%	Latvia	0.54%
Slovenia	0.76%	Iceland	0.51%
Perú	0.76%	Lithuania	0.51%
Mexico	0.66%	Slovenia	0.47%
Greece	0.59%	Israel	0.47%
Israel	0.58%	Norway	0.46%
Sweden	0.52%	Czech Republic	0.45%
Chile	0.48%	Estonia	0.44%
Korea	0.45%	Hungary	0.42%
Hong Kong	0.45%	Singapore	0.41%
Colombia	0.44%	Korea	0.39%
Japan	0.35%	Luxembourg	0.39%
Iceland	0.34%	Ireland	0.38%
United Kingdom	0.34%	Greece	0.37%
Canada	0.33%	Canada	0.35%
Portugal	0.32%	United States	0.35%
Germany	0.30%	Chile	0.35%
Singapore	0.28%	Brazil	0.34%
Finland	0.26%	Sweden	0.34%
Ireland	0.26%	Poland	0.33%
Norway	0.25%	Belgium	0.31%
Austria	0.24%	Perú	0.31%
Switzerland	0.24%	Finland	0.30%
Spain	0.23%	Spain	0.28%
Netherlands	0.22%	Portugal	0.28%
Belgium	0.21%	Colombia	0.28%
Denmark	0.18%	Germany	0.27%
France	0.17%	Switzerland	0.27%
Luxembourg	0.16%	Mexico	0.26%
Italy	0.15%	Denmark	0.26%
United States	0.14%	Japan	0.25%
Estonia	0.00%	United Kingdom	0.25%
Bulgaria	0.00%	Austria	0.24%
Lithuania	0.00%	France	0.24%
Latvia	0.00%	Netherlands	0.22%
Romania	0.00%	Italy	0.14%

Coeficiente de variación

1991.01-1998.12		1999.1-2009.6	
Japan	4.90	Taiwan	11.20
Taiwan	3.87	Singapore	4.53
Sweden	2.98	Switzerland	4.48
Canada	2.49	Greece	4.05
Singapore	2.18	Luxembourg	3.56
Austria	2.16	Sweden	3.40
Finland	2.13	Israel	3.40
United Kingdom	2.11	Norway	2.71
Switzerland	2.08	Germany	2.51
Netherlands	1.91	United Kingdom	2.49
Ireland	1.84	Netherlands	2.44
Belgium	1.73	Finland	2.38
Iceland	1.61	Czech Republic	2.27
Greece	1.60	Lithuania	2.24
Denmark	1.58	Canada	2.07
Norway	1.53	Denmark	2.05
Germany	1.51	Ireland	1.98
Slovenia	1.44	United States	1.97
Czech Republic	1.39	Spain	1.95
Slovak Republic	1.37	Slovak Republic	1.89
France	1.34	Portugal	1.86
Perú	1.21	France	1.83
Korea	1.20	Belgium	1.76
Brazil	1.18	Korea	1.76
Luxembourg	1.13	Bulgaria	1.74
Portugal	1.01	Chile	1.57
Spain	0.98	Austria	1.52
Hong Kong	0.98	Perú	1.50
Hungary	0.90	Estonia	1.41
Poland	0.89	Latvia	1.39
Mexico	0.81	Poland	1.36
Chile	0.79	Slovenia	1.22
Israel	0.75	Iceland	1.16
United States	0.71	Turkey	1.03
Italy	0.62	Hungary	1.01
Colombia	0.55	Romania	0.93
Turkey	0.51	Colombia	0.89
Estonia	0.00	Mexico	0.85
Bulgaria	0.00	Italy	0.80
Lithuania	0.00	Brazil	0.78
Latvia	0.00	Japan	-12.25
Romania	0.00	Hong Kong	-19.38

Cuadro 3
Estadísticos obtenidos con la inflación mensual del IPCX subyacente con AR(12)

Suma de coef.

1991.01-1998.12		1999.1-2009.6	
Hong Kong	1.38	Turkey	0.94
Spain	0.96	Poland	0.92
Austria	0.95	Hungary	0.89
Brazil	0.94	Slovenia	0.85
Luxembourg	0.92	Colombia	0.85
Portugal	0.91	Perú	0.81
Greece	0.90	Mexico	0.81
France	0.89	Brazil	0.80
Perú	0.86	Portugal	0.79
Italy	0.86	Latvia	0.78
Belgium	0.86	Ireland	0.78
Switzerland	0.85	Romania	0.73
Chile	0.82	Finland	0.69
Mexico	0.81	Hong Kong	0.68
Netherlands	0.80	Estonia	0.67
Hungary	0.80	Netherlands	0.67
Sweden	0.76	France	0.67
Germany	0.73	Lithuania	0.63
Latvia	0.70	Spain	0.59
Poland	0.70	Sweden	0.57
Lithuania	0.67	Iceland	0.54
United States	0.65	Slovak Repub	0.50
Singapore	0.65	Korea	0.49
Israel	0.63	Switzerland	0.46
Ireland	0.57	United States	0.44
Finland	0.55	Czech Repub	0.42
Denmark	0.53	Bulgaria	0.40
Korea	0.51	Singapore	0.39
United Kingdc	0.50	Israel	0.37
Japan	0.44	Chile	0.37
Canada	0.44	Austria	0.36
Norway	0.33	United Kingdc	0.36
Turkey	0.15	Norway	0.35
Taiwan	0.01	Denmark	0.28
Slovak Repub	-0.22	Italy	0.24
Iceland	-0.35	Japan	0.16
Czech Repub	-0.50	Canada	0.12
Slovenia	--	Belgium	0.11
Colombia	--	Germany	0.02
Estonia	--	Greece	-0.04
Bulgaria	--	Luxembourg	-0.14
Romania	--	Taiwan	-1.30

Desv.est. de los errores

1991.01-1998.12		1999.1-2009.6	
Brazil	5.25%	Turkey	0.66%
Czech Repub	0.85%	Hong Kong	0.54%
Turkey	0.84%	Bulgaria	0.50%
Latvia	0.69%	Taiwan	0.48%
Perú	0.62%	Slovak Repub	0.45%
Mexico	0.57%	Lithuania	0.40%
Israel	0.52%	Iceland	0.36%
Hungary	0.50%	Israel	0.35%
Sweden	0.47%	Singapore	0.30%
Greece	0.38%	Latvia	0.28%
Taiwan	0.36%	Czech Repub	0.26%
Canada	0.32%	Norway	0.24%
Hong Kong	0.32%	Estonia	0.24%
Lithuania	0.30%	Romania	0.22%
Slovak Repub	0.27%	Luxembourg	0.21%
Poland	0.27%	Sweden	0.21%
Finland	0.26%	Chile	0.20%
Germany	0.25%	Ireland	0.20%
Chile	0.25%	Slovenia	0.19%
Korea	0.24%	Brazil	0.18%
Japan	0.19%	Canada	0.16%
Singapore	0.18%	Poland	0.15%
Belgium	0.17%	Finland	0.15%
Iceland	0.17%	Greece	0.15%
Ireland	0.16%	Perú	0.14%
United Kingdc	0.16%	Netherlands	0.14%
Norway	0.13%	Germany	0.13%
Switzerland	0.12%	Korea	0.13%
Italy	0.12%	Denmark	0.13%
Denmark	0.11%	Portugal	0.12%
Austria	0.10%	United Kingdc	0.12%
Spain	0.10%	Belgium	0.11%
Portugal	0.10%	Hungary	0.11%
France	0.09%	Colombia	0.11%
Luxembourg	0.09%	Italy	0.11%
United States	0.07%	France	0.10%
Netherlands	0.07%	Austria	0.09%
Slovenia	--	Japan	0.09%
Colombia	--	United States	0.08%
Estonia	--	Mexico	0.08%
Bulgaria	--	Spain	0.07%
Romania	--	Switzerland	0.04%

Coeficiente de variación

1991.01-1998.12		1
Sweden	2.21	Taiwan
Taiwan	1.98	Israel
Canada	1.96	Singapore
Japan	1.82	Lithuania
Finland	1.57	Sweden
Iceland	1.38	Norway
Singapore	1.33	Luxembourg
Switzerland	1.19	Germany
Brazil	1.16	Finland
Germany	1.08	Ireland
Czech Repub	0.97	United Kingdc
Belgium	0.93	Slovak Repub
Latvia	0.89	Czech Repub
United Kingdc	0.89	Canada
Ireland	0.86	Poland
Perú	0.83	Chile
Hong Kong	0.77	Estonia
Norway	0.76	Netherlands
France	0.72	Turkey
Mexico	0.71	Bulgaria
Austria	0.69	Latvia
Israel	0.68	Denmark
Denmark	0.68	France
Luxembourg	0.68	Perú
Korea	0.63	Iceland
Greece	0.57	Slovenia
Portugal	0.56	Belgium
Lithuania	0.48	Korea
Chile	0.48	Switzerland
Italy	0.46	Austria
Slovak Repub	0.45	Portugal
Spain	0.45	Italy
Netherlands	0.42	Greece
Hungary	0.41	Mexico
United States	0.38	Hungary
Poland	0.29	Brazil
Turkey	0.16	Romania
Slovenia	--	United States
Colombia	--	Spain
Estonia	--	Colombia
Bulgaria	--	Japan
Romania	--	Hong Kong

Cuadro 3A
Estadísticos obtenidos con inflación mensual del IPCX subyacente sin desestacionalizar conAR(12)

Suma de coef.				Desv.est. de los errores				Coeficiente de variación			
1991.01-1998.12		1999.1-2009.6		1991.01-1998.12		1999.1-2009.6		1991.01-1998.12		1999.1-2009.6	
Hong Kong	1.57	Ireland	0.96	Brazil	5.26%	Turkey	0.85%	Japan	3.79	Taiwan	20.61
Luxembourg	0.94	Turkey	0.93	Turkey	1.34%	Hong Kong	0.60%	Sweden	2.82	Singapore	6.34
Brazil	0.94	Poland	0.82	Czech Repub	0.89%	Taiwan	0.60%	Taiwan	2.74	Israel	6.18
Spain	0.94	Latvia	0.79	Perú	0.78%	Bulgaria	0.57%	Austria	2.41	Switzerland	5.78
France	0.92	Perú	0.79	Hungary	0.78%	Slovak Repub	0.51%	United Kingdc	2.19	Sweden	5.58
Italy	0.89	Hungary	0.79	Latvia	0.71%	Israel	0.47%	Canada	2.14	Greece	5.27
Switzerland	0.85	Brazil	0.78	Israel	0.64%	Iceland	0.45%	Netherlands	2.13	Luxembourg	4.92
Austria	0.85	Slovenia	0.77	Mexico	0.61%	Latvia	0.43%	Denmark	1.99	Germany	4.20
Hungary	0.83	Mexico	0.75	Sweden	0.57%	Slovenia	0.42%	Ireland	1.93	United Kingdc	4.06
Greece	0.83	Colombia	0.72	Taiwan	0.52%	Lithuania	0.41%	Finland	1.86	Finland	3.25
Mexico	0.81	Lithuania	0.66	Greece	0.52%	Romania	0.41%	Switzerland	1.83	Netherlands	3.19
Perú	0.81	Portugal	0.66	Slovak Repub	0.41%	Singapore	0.40%	Norway	1.75	Spain	3.15
Belgium	0.79	Hong Kong	0.64	Hong Kong	0.38%	Czech Repub	0.38%	Iceland	1.74	Denmark	3.11
Portugal	0.78	Iceland	0.63	Poland	0.37%	Ireland	0.36%	Singapore	1.73	Lithuania	2.95
Chile	0.75	Finland	0.63	Lithuania	0.37%	Norway	0.33%	Greece	1.66	Norway	2.83
Germany	0.74	Netherlands	0.60	Canada	0.35%	Hungary	0.33%	Belgium	1.53	Czech Repub	2.33
Latvia	0.73	Korea	0.60	Chile	0.33%	Luxembourg	0.32%	Czech Repub	1.45	Portugal	2.31
Lithuania	0.73	Estonia	0.60	Finland	0.32%	Greece	0.30%	Germany	1.37	Ireland	2.18
Sweden	0.73	Romania	0.58	Korea	0.31%	Estonia	0.30%	Perú	1.33	France	2.10
Singapore	0.66	Slovak Repub	0.58	Germany	0.30%	Sweden	0.29%	France	1.18	Austria	1.73
Netherlands	0.65	France	0.50	United Kingdc	0.29%	Chile	0.28%	Brazil	1.16	Canada	1.72
Israel	0.63	United States	0.44	Ireland	0.29%	Poland	0.25%	Latvia	1.01	Slovenia	1.60
United States	0.60	Israel	0.41	Portugal	0.26%	Portugal	0.25%	Korea	0.97	Latvia	1.52
Korea	0.60	Bulgaria	0.38	Singapore	0.26%	Spain	0.23%	Luxembourg	0.95	Poland	1.46
Finland	0.56	Denmark	0.38	Japan	0.25%	Germany	0.23%	Hong Kong	0.94	Chile	1.39
Japan	0.49	Norway	0.36	Austria	0.25%	Canada	0.23%	Portugal	0.91	Slovak Repub	1.35
Canada	0.46	Singapore	0.31	Belgium	0.23%	Finland	0.23%	United States	0.82	Belgium	1.26
Poland	0.41	Chile	0.27	Iceland	0.22%	Korea	0.22%	Israel	0.81	Korea	1.15
Ireland	0.34	Sweden	0.24	Norway	0.20%	Netherlands	0.22%	Hungary	0.79	Estonia	1.14
Denmark	0.28	Italy	0.19	Switzerland	0.20%	Austria	0.21%	Mexico	0.76	United States	1.10
Norway	0.20	Czech Repub	0.18	Netherlands	0.19%	Denmark	0.21%	Slovak Repub	0.72	Iceland	1.09
United Kingdc	0.17	United Kingdc	0.16	Denmark	0.18%	Brazil	0.20%	Spain	0.66	Perú	1.07
Slovenia	0.00	Austria	0.12	Spain	0.17%	United Kingdc	0.20%	Lithuania	0.62	Bulgaria	1.04
Colombia	0.00	Canada	-0.01	Italy	0.17%	Perú	0.19%	Italy	0.59	Turkey	0.99
Estonia	0.00	Belgium	-0.02	Luxembourg	0.14%	Switzerland	0.17%	Chile	0.57	Hungary	0.94
Bulgaria	0.00	Spain	-0.04	France	0.14%	Belgium	0.17%	Poland	0.55	Italy	0.83
Romania	0.00	Japan	-0.20	United States	0.12%	France	0.16%	Turkey	0.29	Colombia	0.75
Slovak Repub	-0.32	Germany	-0.49	Slovenia	0.00%	Colombia	0.16%	Slovenia	0.00	Mexico	0.75
Taiwan	-0.41	Greece	-0.65	Colombia	0.00%	Mexico	0.15%	Colombia	0.00	Romania	0.69
Turkey	-0.43	Switzerland	-0.82	Estonia	0.00%	Japan	0.14%	Estonia	0.00	Brazil	0.51
Czech Repub	-0.47	Luxembourg	-1.43	Bulgaria	0.00%	Italy	0.13%	Bulgaria	0.00	Japan	-7.36
Iceland	-0.87	Taiwan	-2.21	Romania	0.00%	United States	0.11%	Romania	0.00	Hong Kong	-13.19

Cuadro 4
Estadísticos obtenidos con un AR(1) de la inflación mensual del IPC total y del IPCX

Coef. del rezago IPC Total

1990.1	1998.12	1999.1	2009.6
Poland	0.91	Israel	0.83
Singapore	0.85	Sweden	0.83
Norway	0.81	Singapore	0.77
Chile	0.76	Romania	0.71
Switzerland	0.73	Norway	0.67
Slovak Repu	0.72	Chile	0.62
Korea	0.64	Slovak Repu	0.49
Iceland	0.59	Iceland	0.45
Ireland	0.58	Ireland	0.44
United State	0.55	Italy	0.43
Taiwan	0.51	Japan	0.43
Hungary	0.50	United State	0.31
Hong Kong	0.48	Spain	0.29
Italy	0.47	Taiwan	0.29
Austria	0.41	Poland	0.29
Czech Repu	0.41	Turkey	0.28
Mexico	0.41	Denmark	0.24
United Kingc	0.37	Latvia	0.22
Perú	0.34	Estonia	0.20
Netherlands	0.31	Hong Kong	0.20
Denmark	0.31	Switzerland	0.19
Sweden	0.29	Bulgaria	0.18
Israel	0.28	Czech Repu	0.17
Greece	0.26	United Kingc	0.10
France	0.25	France	0.09
Belgium	0.24	Lithuania	0.07
Brazil	0.23	Portugal	0.06
Turkey	0.20	Perú	0.06
Germany	0.18	Canada	0.05
Canada	0.10	Luxembourg	0.02
Finland	0.09	Brazil	0.01
Spain	0.08	Germany	-0.01
Japan	0.08	Belgium	-0.02
Luxembourg	0.06	Finland	-0.02
Slovenia	0.06	Mexico	-0.03
Estonia	0.00	Korea	-0.05
Bulgaria	0.00	Slovenia	-0.08
Lithuania	0.00	Austria	-0.09
Latvia	0.00	Hungary	-0.17
Romania	0.00	Greece	-0.19
Portugal	-0.06	Colombia	-0.21
Colombia	-0.23	Netherlands	-0.39

Coeficiente de variación IPC Total

1991.01-1998.12		1999.1-2009.6	
Turkey	4.625	Colombia	11.39
Colombia	3.417	Iceland	3.52
Luxembourg	2.673	Slovenia	3.39
Brazil	2.220	Lithuania	3.01
Canada	1.861	Spain	2.21
Poland	1.493	Brazil	1.94
Slovenia	1.400	Canada	1.63
France	1.369	France	1.55
Italy	1.311	United Kingc	1.51
United Kingc	1.221	Mexico	1.41
Belgium	1.197	Greece	1.38
Denmark	1.157	Denmark	1.36
Greece	1.149	Bulgaria	1.35
Chile	1.125	Turkey	1.31
Perú	1.077	Belgium	1.29
Singapore	1.042	Germany	1.25
Germany	1.037	Estonia	1.21
Spain	0.921	Netherlands	1.18
Mexico	0.874	Hong Kong	1.15
Finland	0.873	Taiwan	1.09
Japan	0.822	Portugal	1.03
Czech Repu	0.780	Latvia	1.00
Netherlands	0.770	Perú	0.98
Portugal	0.768	Sweden	0.97
Taiwan	0.733	Austria	0.95
Austria	0.713	Chile	0.94
Switzerland	0.680	Italy	0.92
Hungary	0.676	Poland	0.88
Norway	0.661	Israel	0.85
Iceland	0.628	Romania	0.82
Sweden	0.621	Finland	0.80
Hong Kong	0.551	Hungary	0.71
United State	0.536	Japan	0.67
Korea	0.486	Switzerland	0.65
Ireland	0.466	Ireland	0.64
Israel	0.413	Singapore	0.60
Slovak Repu	0.254	Norway	0.53
Estonia	0.000	United State	0.52
Bulgaria	0.000	Korea	0.47
Lithuania	0.000	Slovak Repu	0.43
Latvia	0.000	Czech Repu	-4.13
Romania	0.000	Luxembourg	-4.81

Coef. del rezago IPCX

1990.1	1998.12	1999.1	2009.6
Portugal	0.87	Turkey	0.90
Brazil	0.86	Romania	0.83
Mexico	0.80	Hungary	0.82
Poland	0.79	Ireland	0.79
Perú	0.79	Mexico	0.79
Spain	0.68	Poland	0.77
Luxembourg	0.68	Brazil	0.69
Switzerland	0.67	Perú	0.60
Hong Kong	0.62	Colombia	0.58
Chile	0.58	Latvia	0.53
Hungary	0.58	Israel	0.50
Israel	0.56	Slovenia	0.47
Austria	0.55	Spain	0.46
Greece	0.53	Finland	0.46
Italy	0.48	Iceland	0.45
United Kingc	0.45	Switzerland	0.42
United State	0.44	Chile	0.38
Korea	0.41	Estonia	0.37
Netherlands	0.37	Portugal	0.32
France	0.36	Korea	0.31
Ireland	0.36	Bulgaria	0.27
Sweden	0.35	Slovak Repu	0.24
Singapore	0.31	Norway	0.22
Iceland	0.30	Sweden	0.21
Latvia	0.29	Lithuania	0.21
Belgium	0.26	Netherlands	0.18
Turkey	0.26	Czech Repu	0.16
Germany	0.23	United State	0.14
Finland	0.19	Canada	0.04
Canada	0.16	Denmark	0.04
Norway	0.16	United Kingc	0.02
Japan	0.10	Austria	0.01
Denmark	0.06	France	-0.01
Slovenia	0.00	Belgium	-0.03
Colombia	0.00	Singapore	-0.05
Estonia	0.00	Italy	-0.08
Bulgaria	0.00	Hong Kong	-0.11
Romania	0.00	Greece	-0.13
Slovak Repu	0.00	Japan	-0.21
Czech Repu	-0.02	Germany	-0.36
Lithuania	-0.05	Taiwan	-0.45
Taiwan	-0.30	Luxembourg	-0.46

Coeficiente de variación IPCX

1991.01-1998.12		1999.1-2009.6	
Brazil	2.277	Taiwan	16.85
Perú	2.160	Israel	4.57
Sweden	2.028	Singapore	3.80
Taiwan	1.981	Lithuania	2.82
Canada	1.734	Sweden	2.54
Japan	1.597	Norway	1.77
Switzerland	1.468	Luxembourg	1.64
Finland	1.377	Germany	1.54
United Kingc	1.359	Finland	1.43
Iceland	1.353	Ireland	1.36
Singapore	1.266	United Kingc	1.18
Portugal	1.150	Slovak Repu	1.17
Mexico	1.104	Czech Repu	1.13
Germany	1.086	Canada	1.12
Hong Kong	0.910	Poland	1.06
Belgium	0.905	Chile	0.98
Czech Repu	0.867	Estonia	0.94
Luxembourg	0.856	Netherlands	0.93
Ireland	0.850	Bulgaria	0.91
Austria	0.776	Latvia	0.91
Israel	0.770	Denmark	0.89
Norway	0.751	France	0.89
France	0.726	Turkey	0.89
Korea	0.719	Perú	0.88
Chile	0.688	Iceland	0.86
Latvia	0.668	Belgium	0.79
Greece	0.664	Korea	0.74
Denmark	0.649	Slovenia	0.74
Spain	0.586	Switzerland	0.74
Poland	0.540	Austria	0.73
Hungary	0.511	Portugal	0.63
Lithuania	0.511	Italy	0.61
Italy	0.506	Greece	0.60
United State	0.455	Romania	0.54
Netherlands	0.447	Hungary	0.50
Slovak Repu	0.441	Brazil	0.48
Turkey	0.370	United State	0.47
Slovenia	0.000	Spain	0.42
Colombia	0.000	Mexico	0.38
Estonia	0.000	Colombia	0.35
Bulgaria	0.000	Japan	-2.56
Romania	0.000	Hong Kong	-12.01

Cuadro 4A
Estadísticos obtenidos con un AR(1) de la inflación mensual del IPC total y del IPCX sin desestacionalizar

Coef del rezago IPC total				Coeficiente de variación IPC total			
1991.01-1998.12		1999.1-2009.6		1991.01-1998.12		1999.1-2009.6	
Poland	0.89	Israel	0.77	Turkey	4.63	Colombia	13.76
Singapore	0.85	Romania	0.71	Colombia	4.00	Slovenia	5.37
Norway	0.77	Slovak Repub	0.69	Luxembourg	3.97	Iceland	4.46
Slovak Repub	0.67	Singapore	0.62	Brazil	2.52	Chile	4.23
Iceland	0.49	Norway	0.56	Canada	2.14	Hungary	4.01
Taiwan	0.48	Sweden	0.47	Austria	2.12	Netherlands	3.59
Korea	0.47	Iceland	0.39	Slovenia	1.99	Lithuania	3.52
Switzerland	0.46	Taiwan	0.38	Perú	1.89	Brazil	3.39
Mexico	0.43	Switzerland	0.35	France	1.88	Spain	2.76
Italy	0.40	Hong Kong	0.33	Japan	1.84	Perú	2.67
United Kingdo	0.34	Bulgaria	0.32	Portugal	1.84	Greece	2.65
Hong Kong	0.33	Ireland	0.32	Chile	1.83	France	2.64
Israel	0.30	Turkey	0.29	Finland	1.68	Denmark	2.50
Austria	0.28	Portugal	0.27	Belgium	1.68	Portugal	2.49
Sweden	0.28	United States	0.22	Poland	1.56	Mexico	2.04
Ireland	0.26	Italy	0.22	Spain	1.53	Finland	2.04
Czech Republ	0.23	Spain	0.20	Greece	1.49	Bulgaria	1.99
Brazil	0.23	Estonia	0.19	Italy	1.48	United Kingdo	1.89
Greece	0.23	Czech Repub	0.17	Hungary	1.46	Canada	1.87
Denmark	0.23	Finland	0.15	Denmark	1.36	Turkey	1.83
Germany	0.21	Poland	0.14	Germany	1.35	Germany	1.73
Turkey	0.20	Canada	0.14	United Kingdo	1.33	United States	1.64
Luxembourg	0.19	Latvia	0.14	Netherlands	1.21	Hong Kong	1.61
France	0.17	United Kingdo	0.14	Mexico	1.12	Belgium	1.56
Perú	0.16	Mexico	0.13	Singapore	1.06	Taiwan	1.55
United States	0.16	Lithuania	0.12	United States	0.99	Sweden	1.50
Portugal	0.15	Brazil	0.11	Switzerland	0.97	Latvia	1.49
Chile	0.12	France	0.10	Czech Repub	0.91	Switzerland	1.43
Hungary	0.12	Denmark	0.09	Taiwan	0.90	Austria	1.41
Belgium	0.11	Korea	0.08	Ireland	0.88	Japan	1.39
Netherlands	0.11	Luxembourg	0.06	Hong Kong	0.77	Estonia	1.35
Finland	0.06	Germany	0.06	Iceland	0.73	Italy	1.19
Spain	0.02	Hungary	0.04	Sweden	0.72	Poland	1.08
Estonia	0.00	Belgium	0.04	Norway	0.71	Ireland	1.02
Bulgaria	0.00	Chile	-0.02	Korea	0.61	Israel	0.91
Lithuania	0.00	Japan	-0.05	Israel	0.53	Slovak Repub	0.91
Latvia	0.00	Perú	-0.06	Slovak Repub	0.52	Romania	0.82
Romania	0.00	Colombia	-0.18	Estonia	0.00	Singapore	0.81
Canada	-0.05	Austria	-0.22	Bulgaria	0.00	Norway	0.79
Slovenia	-0.13	Slovenia	-0.31	Lithuania	0.00	Korea	0.64
Colombia	-0.21	Greece	-0.39	Latvia	0.00	Czech Repub	-4.79
Japan	-0.27	Netherlands	-0.40	Romania	0.00	Luxembourg	-8.09

Coef del rezago IPCX				Coeficiente de variación IPCX			
1991.01-1998.12		1999.1-2009.6		1991.01-1998.12		1999.1-2009.6	
Portugal	0.87	Turkey	0.90	Taiwan	1.90	Taiwan	16.85
Brazil	0.86	Romania	0.83	Sweden	1.89	Israel	4.57
Mexico	0.80	Hungary	0.82	Canada	1.72	Singapore	3.80
Poland	0.79	Ireland	0.79	Japan	1.60	Lithuania	2.82
Perú	0.79	Mexico	0.79	Finland	1.36	Sweden	2.54
Spain	0.68	Poland	0.77	Iceland	1.29	Norway	1.77
Luxembourg	0.68	Brazil	0.69	United Kingdo	1.22	Luxembourg	1.64
Switzerland	0.67	Perú	0.60	Singapore	1.21	Germany	1.54
Hong Kong	0.62	Colombia	0.58	Switzerland	1.09	Finland	1.43
Chile	0.58	Latvia	0.53	Germany	1.06	Ireland	1.36
Hungary	0.58	Israel	0.50	Brazil	1.05	United Kingdo	1.18
Israel	0.56	Slovenia	0.47	Czech Repub	0.88	Slovak Repub	1.17
Austria	0.55	Spain	0.46	Belgium	0.88	Czech Repub	1.13
Greece	0.53	Finland	0.46	Ireland	0.80	Canada	1.12
Italy	0.48	Iceland	0.45	Norway	0.74	Poland	1.06
United Kingdo	0.45	Switzerland	0.42	Hong Kong	0.74	Chile	0.98
United States	0.44	Chile	0.38	Perú	0.74	Estonia	0.94
Korea	0.41	Estonia	0.37	France	0.68	Netherlands	0.93
Netherlands	0.37	Portugal	0.32	Latvia	0.67	Bulgaria	0.91
France	0.36	Korea	0.31	Korea	0.66	Latvia	0.91
Ireland	0.36	Bulgaria	0.27	Austria	0.65	Denmark	0.89
Sweden	0.35	Slovak Repub	0.24	Denmark	0.65	France	0.89
Singapore	0.31	Norway	0.22	Israel	0.64	Turkey	0.89
Iceland	0.30	Sweden	0.21	Luxembourg	0.63	Perú	0.88
Latvia	0.29	Lithuania	0.21	Mexico	0.62	Iceland	0.86
Belgium	0.26	Netherlands	0.18	Greece	0.57	Belgium	0.79
Turkey	0.26	Czech Republ	0.16	Chile	0.54	Korea	0.74
Germany	0.23	United States	0.14	Portugal	0.53	Slovenia	0.74
Finland	0.19	Canada	0.04	Lithuania	0.51	Switzerland	0.74
Canada	0.16	Denmark	0.04	Slovak Repub	0.45	Austria	0.73
Norway	0.16	United Kingdo	0.02	Italy	0.44	Portugal	0.63
Japan	0.10	Austria	0.01	Spain	0.43	Italy	0.61
Denmark	0.06	France	-0.01	Hungary	0.42	Greece	0.60
Slovenia	0.00	Belgium	-0.03	Netherlands	0.42	Romania	0.54
Colombia	0.00	Singapore	-0.05	United States	0.41	Hungary	0.50
Estonia	0.00	Italy	-0.08	Turkey	0.36	Brazil	0.48
Bulgaria	0.00	Hong Kong	-0.11	Poland	0.32	United States	0.47
Romania	0.00	Greece	-0.13	Slovenia	0.00	Spain	0.42
Slovak Repub	0.00	Japan	-0.21	Colombia	0.00	Mexico	0.38
Czech Republ	-0.02	Germany	-0.36	Estonia	0.00	Colombia	0.35
Lithuania	-0.05	Taiwan	-0.45	Bulgaria	0.00	Japan	-2.56
Taiwan	-0.30	Luxembourg	-0.46	Romania	0.00	Hong Kong	-12.01

Cuadro 5: Medidas de persistencia.

I (0)							
AR(1)				AR(4)			
1991.1-1998.4		1999.1-2009.2		1991.1-1998.4		1999.1-2009.2	
Switzerlanc	11.048	Turkey	9.160	Spain	18.347	Turkey	10.597
Portugal	10.555	Poland	7.801	Luxembour	12.787	Poland	10.088
Brazil	8.557	Peru	6.195	Greece	11.887	Slovenia	6.641
Latvia	7.599	Colombia	5.947	Austria	11.223	Peru	6.571
Lithuania	7.428	Mexico	5.451	Switzerlanc	10.637	Colombia	5.428
Greece	7.081	Slovenia	5.365	France	9.360	Mexico	5.424
Spain	6.361	Iceland	5.320	Italy	8.393	Hungary	5.367
Italy	5.804	Hungary	4.523	Brazil	6.704	Hong Kong	5.141
France	5.184	Latvia	4.079	Portugal	6.541	Estonia	4.690
Chile	4.714	Brazil	3.958	Belgium	5.772	Iceland	4.355
Poland	4.365	Ireland	3.755	Poland	5.295	Brazil	3.938
Luxembour	3.029	Romania	3.417	Chile	4.751	Finland	3.801
Hungary	2.953	Korea	2.878	Sweden	4.025	Latvia	3.622
Austria	2.846	Finland	2.859	Netherland	3.945	Chile	3.288
Peru	2.570	Lithuania	2.820	United Stat	3.787	Portugal	3.217
United Stat	2.570	Chile	2.549	Germany	3.542	France	3.159
Mexico	2.534	Singapore	2.348	Hungary	3.277	Romania	3.079
Sweden	2.249	Estonia	2.299	Denmark	3.001	Japan	2.989
New Zealai	2.243	France	2.213	Taiwan	2.794	Netherland	2.733
Netherland	2.112	Bulgaria	2.022	Finland	2.691	Sweden	2.635
Australia	2.030	Slovak Rep	1.875	Singapore	2.413	Ireland	2.509
Germany	2.012	Portugal	1.831	Peru	2.329	Lithuania	2.494
Finland	2.003	Hong Kong	1.823	New Zealai	2.133	Korea	2.123
United King	1.860	Sweden	1.793	Mexico	2.113	Singapore	1.961
Singapore	1.808	Czech Rep	1.778	Lithuania	1.994	Czech Rep	1.845
Korea	1.764	Canada	1.775	Japan	1.957	Austria	1.844
Canada	1.733	Netherland	1.702	Australia	1.908	New Zealai	1.690
Denmark	1.652	Japan	1.675	Ireland	1.824	Bulgaria	1.682
Ireland	1.602	Germany	1.600	United King	1.803	Slovak Rep	1.669
Slovak Rep	1.581	Austria	1.572	Canada	1.780	United Stat	1.623
Taiwan	1.536	United Stat	1.544	Korea	1.666	Italy	1.608
Japan	1.516	New Zealai	1.476	Israel	1.558	Taiwan	1.513
Israel	1.491	United King	1.426	Norway	1.462	United King	1.483
Norway	1.486	Italy	1.356	Turkey	1.131	Norway	1.479
Iceland	1.378	Switzerlanc	1.339	Slovak Rep	0.819	Denmark	1.320
Belgium	1.318	Taiwan	1.329	Iceland	0.787	Canada	1.261
Turkey	1.125	Israel	1.319	Czech Rep	0.529	Germany	1.248
Czech Rep	0.945	Belgium	1.302	Latvia	-1.224	Australia	1.196
Hong Kong	-2.618	Greece	1.281	Hong Kong	-2.482	Israel	1.147
Estonia	n.d.	Norway	1.236	Estonia	n.d.	Luxembour	1.114
Slovenia	n.d.	Denmark	1.223	Slovenia	n.d.	Greece	1.090
Colombia	n.d.	Australia	0.960	Colombia	n.d.	Belgium	1.077
Bulgaria	n.d.	Luxembour	0.887	Bulgaria	n.d.	Switzerlanc	0.978
Romania	n.d.	Spain	0.652	Romania	n.d.	Spain	0.954

I (1)							
AR(1)				AR(4)			
1991.1-1998.4		1999.1-2009.2		1991.1-1998.4		1999.1-2009.2	
Hong Kong	1.200	Brazil	1.171	Peru	1.236	Peru	1.288
Switzerlanc	1.166	Mexico	1.012	Brazil	0.961	Mexico	1.071
Brazil	1.147	Peru	0.969	Turkey	0.829	Chile	0.795
Turkey	1.109	Ireland	0.958	Australia	0.778	Ireland	0.794
Peru	0.981	Canada	0.899	Latvia	0.726	Korea	0.779
Slovak Rep	0.937	Lithuania	0.870	Switzerlanc	0.720	Lithuania	0.735
Mexico	0.895	Hungary	0.869	Czech Rep	0.698	Brazil	0.686
Portugal	0.867	Colombia	0.828	Mexico	0.659	Czech Rep	0.658
New Zealai	0.864	Bulgaria	0.826	Italy	0.647	Poland	0.595
United King	0.862	Turkey	0.823	Chile	0.629	Iceland	0.581
Greece	0.820	Latvia	0.805	Hungary	0.618	Estonia	0.578
Hungary	0.813	Germany	0.790	Iceland	0.582	Colombia	0.572
Israel	0.785	Czech Rep	0.774	United King	0.574	Bulgaria	0.566
Italy	0.775	Romania	0.760	Spain	0.546	Sweden	0.563
Australia	0.773	Poland	0.759	Portugal	0.532	Latvia	0.549
Canada	0.747	Greece	0.758	Finland	0.529	Greece	0.546
France	0.745	Slovenia	0.756	New Zealai	0.522	Finland	0.520
Norway	0.722	Slovak Rep	0.747	Netherland	0.521	United Stat	0.518
Ireland	0.720	Israel	0.742	United Stat	0.512	France	0.518
Poland	0.719	Sweden	0.725	Slovak Rep	0.500	Singapore	0.502
Latvia	0.708	Switzerlanc	0.721	Norway	0.461	New Zealai	0.498
Korea	0.702	Finland	0.720	Luxembour	0.459	Austria	0.493
Singapore	0.699	Chile	0.718	France	0.449	Turkey	0.493
Lithuania	0.699	France	0.714	Canada	0.422	Hungary	0.492
Chile	0.695	Netherland	0.710	Sweden	0.418	Slovak Rep	0.481
Taiwan	0.694	Singapore	0.709	Ireland	0.406	Netherland	0.478
Finland	0.690	Belgium	0.707	Singapore	0.401	Israel	0.475
Sweden	0.685	Iceland	0.700	Japan	0.401	Slovenia	0.475
Iceland	0.678	New Zealai	0.692	Germany	0.377	Germany	0.457
Germany	0.673	Austria	0.692	Israel	0.362	Hong Kong	0.452
Spain	0.658	United King	0.692	Korea	0.356	Romania	0.436
Japan	0.657	Taiwan	0.675	Austria	0.351	Japan	0.434
Denmark	0.651	Norway	0.675	Denmark	0.334	Belgium	0.433
Austria	0.629	Portugal	0.671	Poland	0.321	Denmark	0.426
Belgium	0.626	Korea	0.670	Greece	0.316	Canada	0.413
Luxembour	0.614	Hong Kong	0.656	Belgium	0.314	Portugal	0.412
Netherland	0.611	United Stat	0.655	Taiwan	0.290	Norway	0.392
United Stat	0.593	Denmark	0.651	Lithuania	0.136	United King	0.384
Czech Rep	0.586	Japan	0.645	Hong Kong	-4.596	Switzerlanc	0.378
Estonia	n.d.	Italy	0.644	Estonia	n.d.	Spain	0.365
Slovenia	n.d.	Australia	0.631	Slovenia	n.d.	Taiwan	0.363
Colombia	n.d.	Luxembour	0.631	Colombia	n.d.	Italy	0.362
Bulgaria	n.d.	Estonia	0.596	Bulgaria	n.d.	Australia	0.351
Romania	n.d.	Spain	0.544	Romania	n.d.	Luxembour	0.289

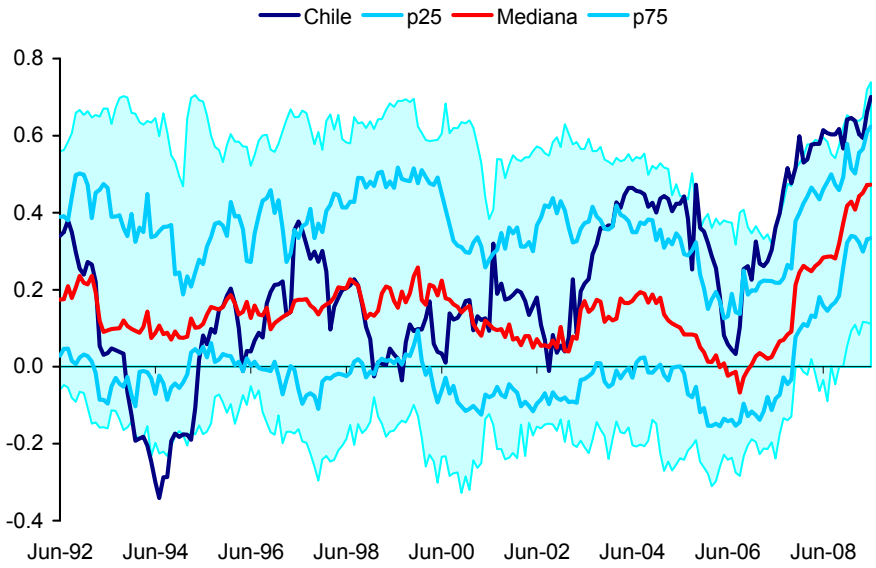
Cuadro 6
Test de Dickey-Fuller aumentado (*)
(valor p; en negrita, no se rechaza la existencia de raíz unitaria)

	1991.1-1998.4		1999.1-2008.4	
	π	$\Delta\pi$	π	$\Delta\pi$
Australia	0.010	0.000	0.000	0.000
Austria	**0.658**	0.000	0.002	0.000
Belgium	**0.812**	0.000	0.001	0.000
Brazil	**0.619**	0.000	**0.131**	0.000
Bulgaria	**0.478**	**0.376**	0.010	0.000
Canada	0.013	0.000	0.007	0.000
Chile	**0.058**	0.000	0.004	0.000
Colombia	0.000	0.000	**0.168**	0.000
Czech Repub	**0.113**	0.001	0.005	0.000
Denmark	**0.214**	0.000	0.000	0.000
Estonia	0.000	0.000	**0.559**	0.000
Finland	0.030	0.000	**0.067**	0.000
France	**0.801**	0.000	0.021	0.000
Germany	0.039	0.000	0.002	0.000
Greece	**0.896**	0.000	0.000	0.000
Hong Kong	**1.000**	**0.157**	**0.622**	0.000
Hungary	**0.166**	0.000	**0.202**	0.000
Iceland	0.001	0.000	**0.921**	0.000
Ireland	0.010	0.000	**0.177**	0.000
Israel	0.007	0.000	0.000	0.000
Italy	**0.475**	0.010	0.002	0.000
Japan	0.006	0.000	**0.262**	0.000
Korea	0.031	0.000	0.005	0.000
Latvia	**0.856**	0.012	**0.177**	0.000
Lithuania	**0.875**	**0.131**	0.044	0.000
Luxembourg	**0.858**	0.000	0.000	0.000
Mexico	**0.079**	0.000	0.000	0.000
Netherlands	0.014	0.000	0.004	0.000
New Zealand	**0.165**	0.000	0.000	0.000
Norway	0.002	0.000	0.000	0.000
Peru	0.016	0.000	**0.369**	**0.186**
Poland	**0.438**	0.000	**0.462**	0.000
Portugal	**0.688**	0.000	0.010	0.000
Romania	0.000	0.000	0.008	0.000
Singapore	0.008	0.000	0.026	0.000
Slovak Repub	0.027	0.045	0.008	0.000
Slovenia	0.000	0.000	**0.565**	0.000
Spain	**0.863**	0.000	0.031	0.000
Sweden	**0.311**	0.000	0.005	0.000
Switzerland	**0.530**	0.001	0.001	0.000
Taiwan	0.007	0.000	0.000	0.000
Turkey	0.000	0.000	**0.432**	0.000
United Kingdc	0.012	0.000	0.001	0.000
United States	**0.135**	0.000	0.005	0.000

(*) Considera estimación con constante.

Gráfico 3

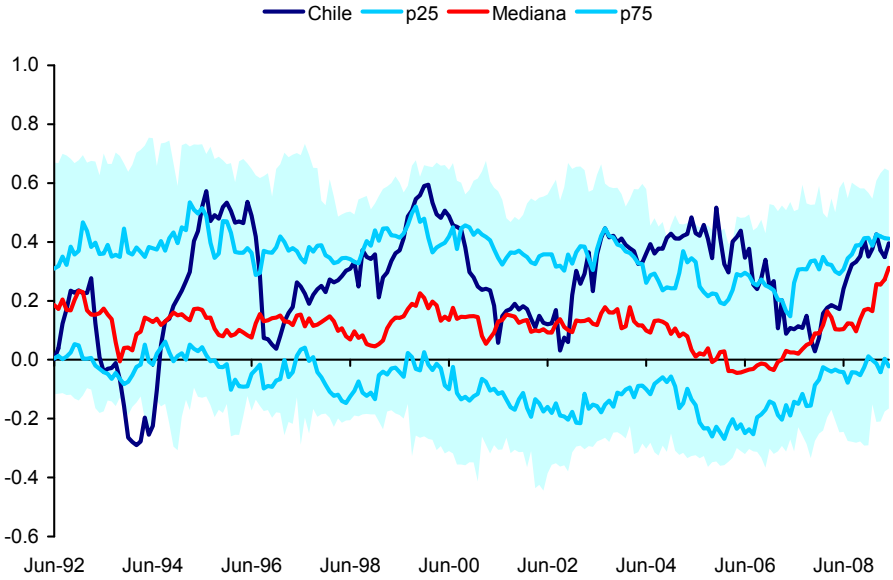
Persistencia de la inflación mensual del IPC total
(desviación estándar, ventana móvil de 30 meses)



Nota: Estimación de proceso autorregresivo. Inflación mensual ajustada por tramo/seats.
Área celeste representa la zona entre los percentiles 10 y 90.
Fuente: Elaboración de los autores.

Gráfico 4

Persistencia de la inflación mensual del IPC subyacente
(desviación estándar, ventana móvil de 30 meses)



Nota: Estimación de proceso autorregresivo. Inflación mensual ajustada por tramo/seats.
Área celeste representa la zona entre los percentiles 10 y 90.
Fuente: Elaboración de los autores.

Gráfico 5
Evolución Precio Petróleo

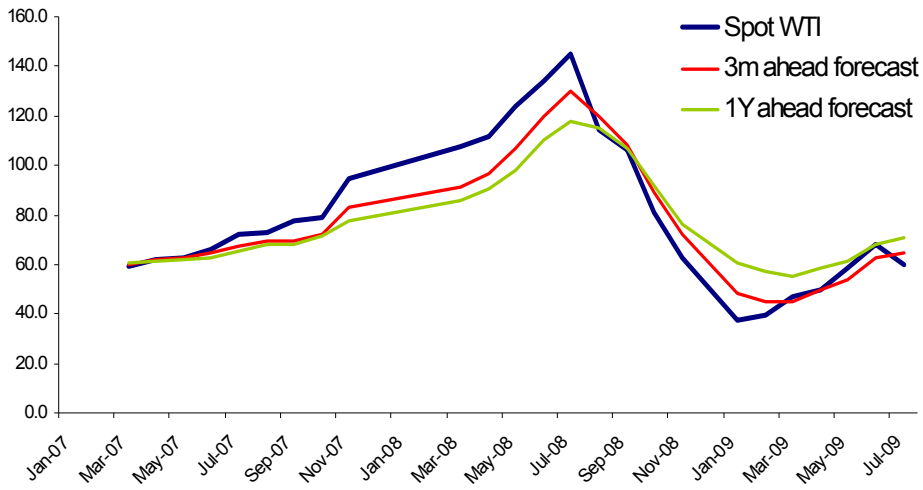
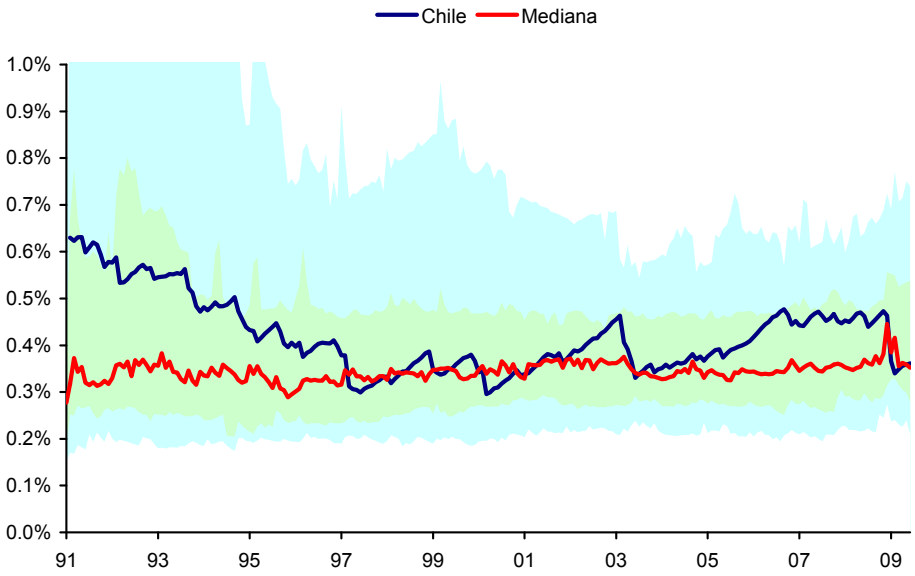


Gráfico 6

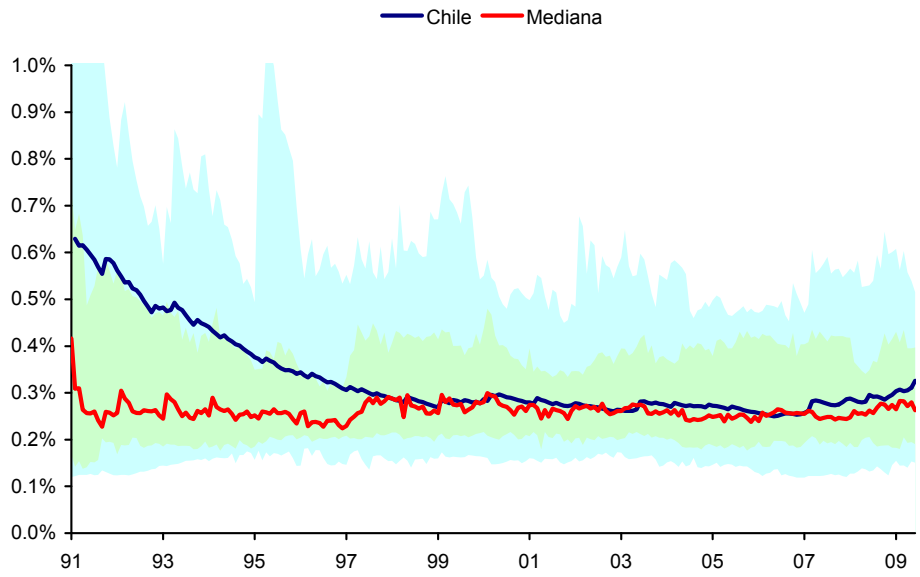
Volatilidad condicional (GARCH) de la inflación mensual del IPC total
(desviación estándar)



Nota: Estimación mediante GARCH(1,1) y serie ajustada por tramo/seats.
El área verde representa la zona entre los percentiles 25 y 75, mientras que la celeste representa la zona entre los percentiles 10 y 90.
Fuente: Elaboración de los autores.

Gráfico 7

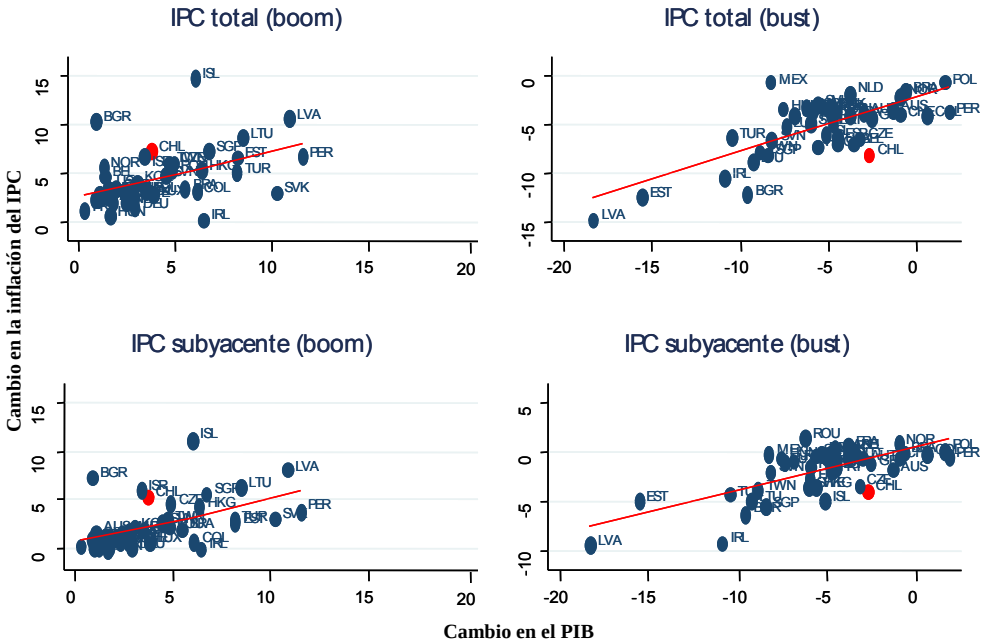
Volatilidad condicional (GARCH) de la inflación mensual del IPC subyacente
(desviación estándar)



Nota: Estimación mediante GARCH(1,1) y serie ajustada por tramo/seats.
El área verde representa la zona entre los percentiles 25 y 75, mientras que la celeste representa la zona entre los percentiles 10 y 90.
Fuente: Elaboración de los autores.

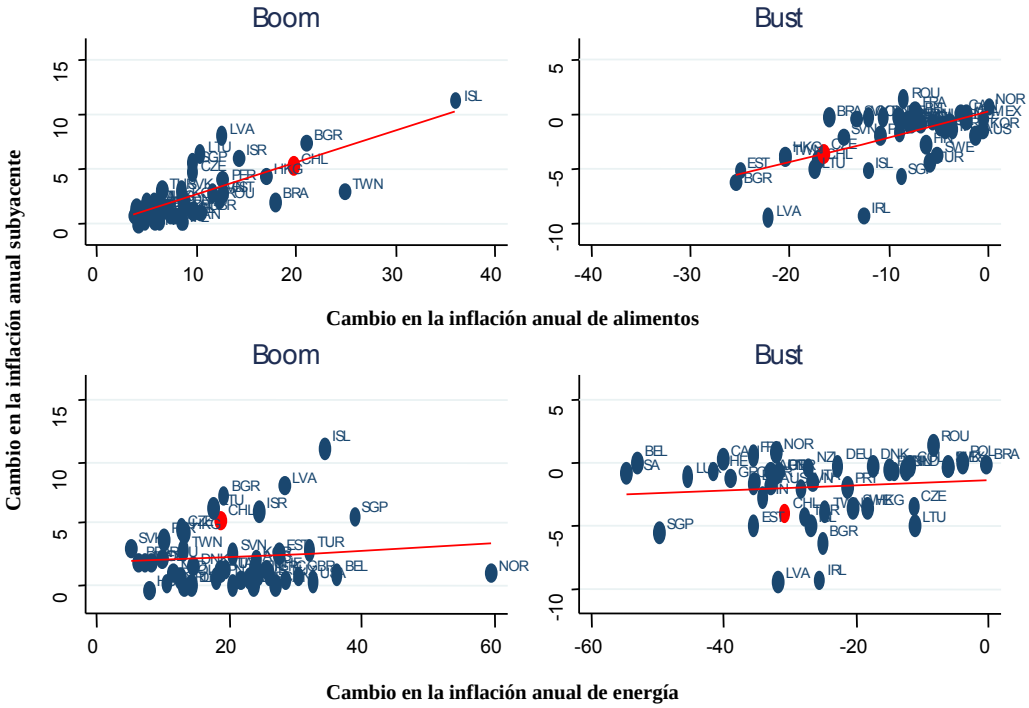
Gráfico 8

Cambio en la inflación vs cambio en el PIB



Fuente: cálculos de los autores

Gráfico 9
Cambios de precios de alimentos y energía y cambios en inflación subyacente



Fuente: cálculos de los autores

Cuadro 7
Estimación de curva de Phillips para un corte transversal de países

Variable dependiente: cambio en la inflación anual del IPC subyacente
Muestra: Boom & Bust

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
π_{ns}	**0.094****	**0.234****	**0.094****	**0.281****	**0.093****	**0.235****	**0.093****	**0.235****	**0.075****	**0.210****	**0.077****	**0.261****
	(3.8)	(6.59)	(3.68)	(7.17)	(3.78)	(6.65)	(3.75)	(6.49)	(3.05)	(5.74)	(3.03)	(6.66)
$\pi_{ns}(y-\bar{y})$	0.001	0.004	0.001	**0.005+**	0.001	0.004	0.001	0.004	0.004	**0.006***	0.005	**0.008****
	(0.29)	(1.49)	(0.29)	(1.94)	(0.33)	(1.56)	(0.39)	(1.44)	(1.38)	(2.2)	(1.52)	(2.89)
$(y-\bar{y})$	**0.263****	**0.330****	**0.263****	**0.324****	**0.266****	**0.334****	**0.266****	**0.330****	**0.191****	**0.273****	**0.188****	**0.266****
	(4.06)	(5.62)	(3.99)	(5.69)	(4.09)	(5.71)	(4.07)	(5.58)	(2.81)	(4.3)	(2.69)	(4.38)
$\hat{q}$			0	**-0.050***							-0.013	**-0.059****
			(0.01)	(2.5)							(0.59)	(2.84)
Expectativa de inflación									**0.414****	**0.297***	**0.428****	**0.323***
									(2.74)	(2.15)	(2.77)	(2.44)
Apertura							-0.148	0.036			-0.146	-0.122
							(0.56)	(0.15)			(0.51)	(0.51)
Controles de precios					-0.096	-0.118					-0.087	-0.124
					(0.96)	(1.34)					(0.87)	(1.45)
Dummy		**-4.946****		**-6.108****		**-5.010****		**-4.971****		**-4.555****		**-5.872****
		(5)		(5.73)		(5.08)		(4.93)		(4.62)		(5.63)
Constante	0.42	**2.846****	0.42	**3.767****	0.997	**3.585****	1.502	2.593	0.342	**2.599****	2.023	**5.290****
	(1.53)	(5.25)	(1.34)	(5.87)	(1.51)	(4.65)	(0.78)	(1.5)	(1.29)	(4.79)	(0.97)	(2.83)
Observacione	87	87	87	87	87	87	87	87	87	87	87	87
R cuadrado	0.7	0.77	0.7	0.79	0.71	0.78	0.7	0.77	0.73	0.78	0.73	0.81

Valor absoluto del estadístico *t* entre paréntesis.
+ significativo al 10%; * significativo al 5%; ** significativo al 1%

Variable dependiente: cambio en la inflación anual del IPC subyacente
Muestra: Boom & Bust

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
π_{ns}	**0.077****	**0.217****	**0.073****	**0.255****	**0.076****	**0.218****	**0.073****	**0.215****	**0.054***	**0.188****	**0.054***	**0.230****
	(2.95)	(6.4)	(2.68)	(6.65)	(2.92)	(6.48)	(2.81)	(6.18)	(2.09)	(5.34)	(2.02)	(6.06)
$\pi_{ns}d(y-\bar{y})$	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.002	**0.003+**	**0.003+**	**0.004+**	**0.004****
	(0.39)	(1.08)	(0.34)	(1.43)	(0.49)	(1.23)	(0.6)	(1.1)	(1.7)	(1.97)	(1.96)	(2.79)
$d(y-\bar{y})$	**0.185****	**0.230****	**0.188****	**0.221****	**0.187****	**0.233****	**0.190****	**0.231****	**0.143****	**0.198****	**0.144****	**0.187****
	(4.61)	(6.49)	(4.57)	(6.28)	(4.66)	(6.62)	(4.7)	(6.45)	(3.56)	(5.32)	(3.42)	(5.17)
$\hat{q}$			0.009	-0.039+							-0.011	**-0.053***
			(0.42)	(1.99)							(0.5)	(2.61)
Expectativa de inflación									**0.440****	**0.296***	**0.456****	**0.336****
									(3.13)	(2.33)	(3.17)	(2.73)
Apertura							-0.259	-0.062			-0.227	-0.187
							(1)	(0.27)			(0.83)	(0.81)
Controles de precios					-0.101	-0.126					-0.096	-0.133
					(1.03)	(1.5)					(0.99)	(1.62)
Dummy		**-5.155****		**-5.983****		**-5.227****		**-5.112****		**-4.659****		**-5.652****
		(5.5)		(5.92)		(5.61)		(5.35)		(4.97)		(5.76)
Constante	0.416	**3.058****	0.36	**3.728****	1.015	3.839**	2.308	**3.487***	0.309	**2.732****	2.602	**5.710****
	(1.52)	(5.72)	(1.17)	(5.97)	(1.58)	(5.16)	(1.21)	(2.1)	(1.18)	(5.06)	(1.28)	(3.18)
Observations	87	87	87	87	87	87	87	87	87	87	87	87
R-squared	0.71	0.79	0.72	0.8	0.72	0.8	0.72	0.79	0.74	0.8	0.75	0.83

Valor absoluto del estadístico *t* entre paréntesis.
+ significativo al 10%; * significativo al 5%; ** significativo al 1%

Cuadro 8
Estimación de curva de Phillips para un corte transversal de países

Variable dependiente: cambio en la inflación anual del IPC subyacente
Muestra: Boom

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
π_{ns}	**0.200***	**0.230***	**0.205***	**0.199***	0.115	**0.152+**	**0.185+**	**0.211***	**0.184+**	**0.185+**	0.029	0.059
	(2.11)	(2.45)	(2.19)	(2.07)	(1.43)	(1.83)	(1.96)	(2.24)	(1.99)	(1.94)	(0.38)	(0.76)
$\pi_{ns}(y-\bar{y})$	0.02	0.024	0.022	0.021	**0.031+**	**0.034***						
	(1.09)	(1.32)	(1.21)	(1.1)	(2.01)	(2.18)						
$(y-\bar{y})$	0.085	0.039	0.055	0.074	-0.243	-0.255						
	(0.34)	(0.16)	(0.22)	(0.29)	(1.12)	(1.17)						
$\pi_{ns}d(y-\bar{y})$							0.009	0.01	0.011	0.009	**0.023****	**0.024****
							(0.98)	(1.14)	(1.19)	(0.96)	(3.09)	(3.31)
$d(y-\bar{y})$							0.102	0.08	0.078	0.103	-0.185	**-0.192+**
							(0.79)	(0.62)	(0.61)	(0.78)	(1.67)	(1.76)
$\hat{q}$		**-0.044+**				-0.033		-0.035				-0.029
Expectativa		(1.8)				(1.45)		(1.46)				(1.47)
de inflación					**0.931****	**0.829****					**1.028****	**0.967****
					(4.48)	(3.78)					(5.57)	(5.15)
Apertura				0.095		-0.101				-0.021		-0.196
				(0.31)		(0.37)				(0.07)		(0.81)
Controles de			-0.166			-0.138			-0.181			-0.139
precios			(1.4)			(1.3)			(1.58)			(1.5)
Constante	-1.581	-1.635	-0.636	-2.263	-0.665	0.705	-1.518	-1.556	-0.416	-1.362	0.168	2.299
	(1.32)	(1.4)	(0.47)	(0.9)	(0.66)	(0.33)	(1.28)	(1.33)	(0.31)	(0.55)	(0.18)	(1.18)
Observations	44	44	44	44	44	44	44	44	44	44	44	44
R-squared	0.66	0.68	0.67	0.66	0.77	0.79	0.67	0.69	0.69	0.67	0.82	0.84

Valor absoluto del estadístico *t* entre paréntesis.
+ significativo al 10%; * significativo al 5%; ** significativo al 1%

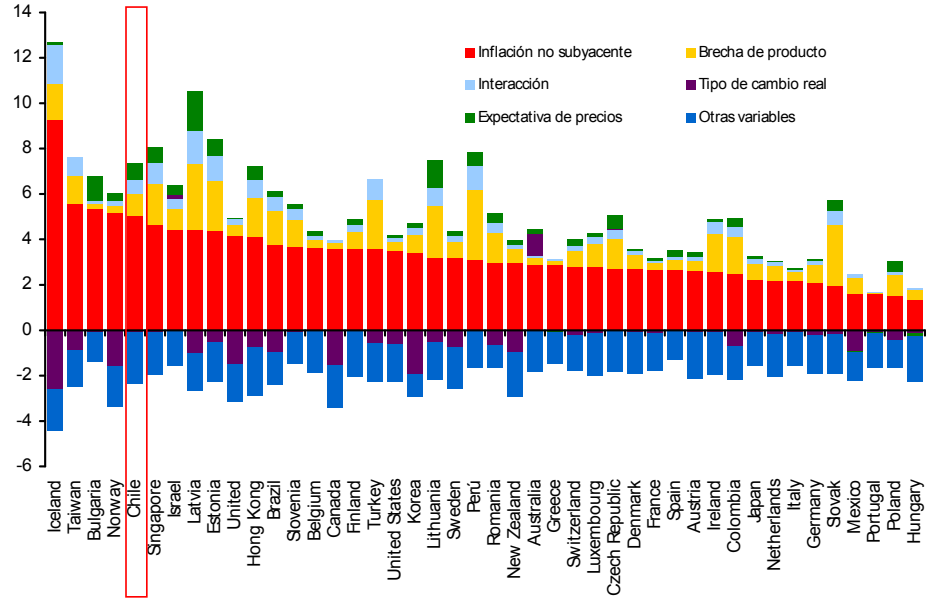
Variable dependiente: cambio en la inflación anual del IPC subyacente
Muestra:Bust

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
π_{ns}	0.099	**0.163+**	0.064	0.092	0.097	0.148	0.13	0.183+	0.112	0.124	0.138	**0.222***
	(1.18)	(1.84)	(0.73)	(1.03)	(1.12)	(1.48)	(1.48)	(1.94)	(1.26)	(1.35)	(1.49)	(2.07)
$\pi_{ns}(y-\bar{y})$	-0.007	-0.005	-0.01	-0.008	-0.008	-0.002						
	(0.83)	(0.54)	(1.08)	(0.86)	(0.71)	(0.12)						
$(y-\bar{y})$	0.194	0.217	0.177	0.184	0.187	0.237						
	(1.15)	(1.32)	(1.05)	(1.05)	(1)	(1.24)						
$\pi_{ns}d(y-\bar{y})$							-0.003	-0.001	-0.003	-0.003	-0.001	0.007
							(0.39)	(0.18)	(0.47)	(0.41)	(0.08)	(0.75)
$d(y-\bar{y})$							0.188	0.194	0.186	0.182	0.213	**0.302+**
							(1.41)	(1.48)	(1.4)	(1.34)	(1.36)	(1.85)
$\hat{q}$		**-0.061+**				**-0.078+**		-0.047				**-0.076+**
Expectativa		(1.86)				(2)		(1.42)				(1.9)
de inflación					-0.023	0.156					0.065	0.304
					(0.11)	(0.67)					(0.31)	(1.27)
Apertura				-0.105		-0.242				-0.102		-0.184
				(0.29)		(0.6)				(0.29)		(0.48)
Controles de			-0.189			-0.147			-0.144			-0.138
precios			(1.4)			(1.06)			(1.12)			(1.03)
Constante	1.172	**2.429+**	1.926	1.834	1.126	**5.179+**	2.034	**2.989+**	**2.708+**	2.68	2.238	**6.339+**
	(0.99)	(1.83)	(1.5)	(0.7)	(0.89)	(1.72)	(1.47)	(1.97)	(1.8)	(1.02)	(1.45)	(2.02)
Observations	43	43	43	43	43	43	43	43	43	43	43	43
R-squared	0.56	0.6	0.58	0.56	0.56	0.63	0.59	0.62	0.61	0.6	0.6	0.65

Valor absoluto del estadístico *t* entre paréntesis.
+ significativo al 10%; * significativo al 5%; ** significativo al 1%

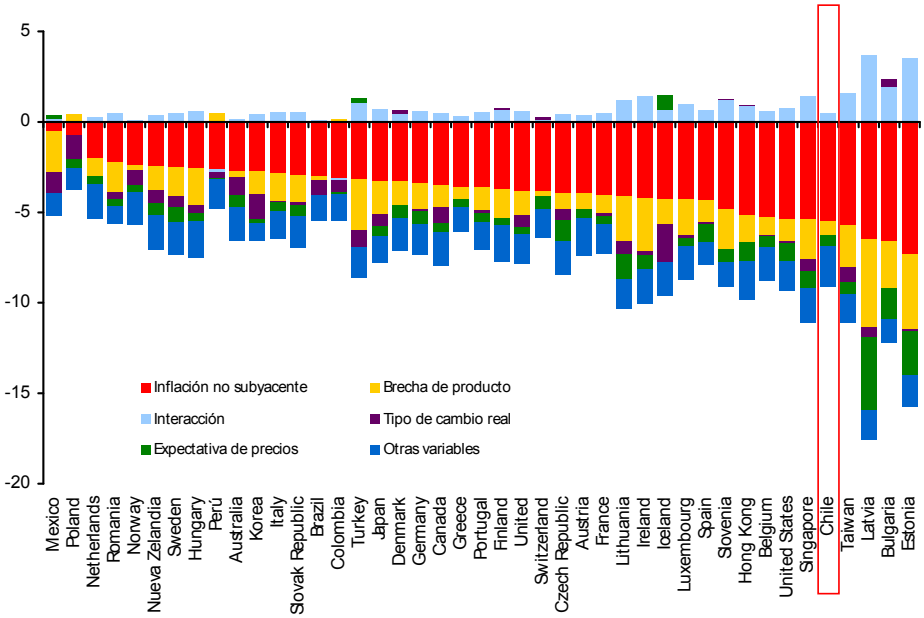
Gráfico 10
Incidencias de las variables en la inflación

Contribuciones al cambio en la inflación anual subyacente en boom
(puntos porcentuales)



Nota: No incluye la constante.
Fuente: Elaboración de los autores

Contribuciones al cambio en la inflación anual subyacente en bust
(puntos porcentuales)



Nota: No incluye la constante.
Fuente: Elaboración de los autores

Commodities Pass Through

Roberto Rigobon[1]
MIT and NBER

First Draft: May 2009

I. Introduction

During the first decade of the 21st century, the world experienced large swings in the prices of mineral and food commodities. Those movements were rare in several dimensions. First, their size. Both set of goods exhibited almost synchronized increases by four times from 2000 until 2007, to see their prices drop by more than three quarters the following couple of years. We haven't seen this magnitude of price changes since the 70's. Second, their co-movement. In normal times prices of minerals and food commodities are usually negatively correlated. Indeed, the unconditional correlation between the two in the last 120 years is negative. Periods of positive co-movement have been only observed during mayor supply disruptions in the last 100 years – where these disruptions were associated with wars and/or revolutions.

These tremendous shifts in relative prices have had implications on changes in domestic relative prices of food and energy for all countries, and these changes have had important effects in emerging markets inflation rates. The impact of international commodity prices into the economy depends on the degree of pass-through from the commodity price to the retail prices; something that has received little attention in the literature. The objective of this paper is to document the pass-through from commodities to retail prices for several Latin American countries, and to evaluate the role that plays the exchange rate in the overall effect. In other words, the purpose of this paper is to estimate simple pass-through regressions from commodity prices to item prices for several countries in Latin America. We are interested in cross-country and cross-sector comparisons, and to evaluate the impact that the different commodity prices have on inflation and changes in domestic relative prices.

Commodities affect domestic prices through very different channels. First, they affect the costs of raw materials. Second, they have an impact on the real exchange rate and the nominal exchange rate. Third, they have an impact on the automatic fiscal and monetary policy stance. Finally, they have an impact on the degree of competition – or markups – in the economy. In this paper we are interested in estimating the overall effect taking into account the exchange rate movement, but not paying attention to the

[1] This paper would have not happen if it were not for the collaboration of several individuals helping in the collection of the micro data. Alberto Gohnzales, Osmel Manzano, Andrew Powell, Cesar Calderon, Pablo Garcia, and Alfredo Pistelli, played a key role in the integration of the data. I thank them tremendously for their help, comments, and efforts. I have benefited from presenting these results in several seminars – far too many to enumerate. I thank the Banco Central de Chile, IDB and the WB for financial support. All remaining errors are mine.

other channels. In other words, we evaluate how the price of bread increases when the price of wheat increases internationally, as well as the price of wheat at the border – hence to evaluate the role of the exchange rate movement – but we will not disentangle how much of the transmission is due to cost, markups, fiscal policy, etc.

One advantage of this approach is that for most countries both the price of the commodity and the exchange rate movement could be considered exogenous to movements of the relative price of a particular sector of good. Nevertheless, there are still several challenges that have to be considered. First, seasonality at the item level is much more damaging and dramatic than at the aggregate level. This complicates the interpretation of the pass-through regressions and needs to be taken into account. Second, several countries have experienced significant disinflation processes that are not necessarily synchronized with commodity price movements. In this regard, if the disinflation occurs at a time in which commodity prices are trending in some direction, then the pass-through regressions might assign a spurious correlation. This problem is particularly pervasive in the beginning of the 2000's in some countries in Latin American and in Eastern Europe (if we were to use that data). Third, commodity prices are denominated in dollars (most of the time) and therefore their pass-through to domestic prices is affected by exchange rate movements which sometimes might not reflect fundamental movements in the short run.

This paper is related to the relatively new literature that studies large micro price datasets. This literature has become an increasingly important and productive area of research in macro and international economics. Several papers have used data -- at the item level and at monthly frequencies -- to study the degree of stickiness, the price change behavior, its synchronization, the behavior of sales, the degree of real rigidities, tests of the theories of price stickiness, and the degree of pass-through; See Bils and Klenow (2004), Gopinath and Rigobon (2008 and 2009), Kehoe and Midrigan (2007), Klenow and Kryvtsov (2008), Lach and Tsiddon (1996), Nakamura and Steinsson (2007), Klenow and Willis (2006) just to mention a few. These papers have used US data, and similar analysis has been performed for European data with similar success by others. So far, there is no comprehensive study of the properties of micro prices in emerging markets, and in particular the estimation of the pass-through. This is a gap this paper is partially trying to fill.

The paper is organized as follows: section 2 describes the data; section 3 describes the methodology; section 4 presents the results; and section 5 concludes.

II. Data

The data was collected by the Banco Central de Chile, the IDB and the World Bank through the different central banks. We obtained monthly data for as many countries as possible, at the finest possible level of detail. We needed at least 10 years of data. The reason is the following: the pass through regressions require eliminating the seasonality, with slow moving trends (disinflation processes), and dealing with long lags. For this reason, we will need at least 10 years of data, at relatively high frequencies - monthly.

Countries with less than this will not be included in the analysis. I had three sources of data and for this project i combined all the data sets taking the best possible one for each country. The countries that satisfy these restrictions are: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, UK, USA, Argentina, Brazil, Chile, Colombia, Peru, Mexico, Uruguay, Algeria, Pakistan, India, China, South Korea, Israel, Taiwan, Japan, Singapore, Philippines, and Russia.

The starting year and the number of items in each country is summarized in Table 1. As can be seen, there is significant variation. Some countries have very detailed information, while others is sparse.

Table 1
Number of items and starting date for each country in the database

	Number of Items	Starting Date		Number of Items	Starting Date
Austria	166	Apr-94	Slovenia	16	Jan-95
Belgium	159	Apr-94	Spain	159	Jun-94
Bulgaria	164	Jan-97	Sweden	163	Mar-94
Cyprus	167	Feb-96	Turkey	163	Jan-96
Czech Republic	16	Jan-95	UK	161	Dec-95
Denmark	165	Mar-94	USA	244	Dec-97
Estonia	123	Mar-95	Uruguay	231	Mar-97
Finland	170	Jul-94	Argentina	7	Jan-90
France	172	Dec-94	Brazil	73	Jul-89
Germany	174	Jul-94	Chile	491	Jan-97
Greece	166	Feb-94	Colombia	103	Jan-97
Hungary	16	Jan-95	Switzerland	44	Jan-90
Iceland	164	Jan-95	Peru	4	Jan-95
Ireland	164	Oct-94	Mexico	434	Jan-88
Italy	166	Feb-94	Algeria	10	Jan-94
Latvia	166	Jan-96	Pakistan	9	Jul-91
Lithuania	166	Nov-95	India	7	Jan-90
Luxembourg	168	Jan-95	China	7	Jan-94
Malta	165	Jan-96	Korea	112	Jan-90
Netherlands	161	Aug-94	Israel	159	Jan-91
Norway	156	Jan-95	Taiwan	103	Jan-90
Poland	180	Jan-96	Japan	118	Jan-90
Portugal	164	Mar-94	Singapore	96	Jan-90
Romania	16	Jan-95	Philippines	137	Jan-90
Slovakia	173	Dec-95	Russia	19	Jan-95

To increase the cross-country comparability instead of concentrating on individual items – which are not frequently repeated across all the countries – we have decided to use relatively aggregated series. From each country we have different sets of items and aggregates series, and for some of them the item data

is already an index. We classify the items in different categories: Bread, rice, maize, flour, oat meal, cereals, cookies, pastas, other cereals, other basic, dairy, oils, sugar and condiments, meat and fish, vegetables, processed food, beverages, restaurant, real estate, housing expenses, services of water, gas, electricity, phone, and other services, gasoline, public, private and other forms of transportation, electronics, electrodomestics, medicines, beauty products, health services, education, education products, clothing, and all other products. Good by good we reclassifying them according to these categories.

We study the impact of the following commodities: agricultural commodities such as wheat, maize, rice, and mineral commodities such as oil, copper, iron, aluminum, and gold. In this paper we present results for only those in which there are interesting and significant results. The exchange rate data and the commodity price data is at least 20 years long.

III. Methodology

This section describes the steps in the estimation procedure. First, each individual series is cleaned up of the seasonality. The second step is to correct for the disinflation effort that was present in several countries. This is a particularly difficult problem to resolve because the disinflation might be confounded with the commodity price trend. In several countries a disinflation occurred at the beginning of the decade. This means that the disinflation occurred exactly at the same time commodity prices were booming. This will add a negative spurious relationship. Third, we estimate simple pass-through regressions.

A. Seasonality

Each series – i.e. each item price series – will be separately de trended and seasonally adjusted using the TRAMO and SEATS procedure. This is a procedure that is used in the Bank of Spain (and the ECB) and is the one that takes into account stochastic seasonality and detrending. The documentation of the procedures can be found in Gomez and Maravall (1997).[2]

TRAMO is a program for estimation and forecasting of regression models that allows for nonstationary errors (ARIMA). The program also corrects for missing values, although that is unlikely to be a problem in our data set. SEATS, on the other hand, is a program that estimates unobservable components in a time series. Using signal extraction methods, the series are split between trend, seasonal, cyclical, and irregular components.

B. Disinflation

A difficult challenge in our data set is that several countries have implemented significant disinflation programs at the same time commodity prices where trending up. This adds a negative spurious

[2] See http://www.bde.es/servicio/software/dose.htm for a detailed description.

relationship between the two. In order to deal with this problem a system of equations will be estimated where the aggregate inflation index, short term interest rates, and the commodity prices are included in the regression. The idea is to control for the disinflation effort in each country.

C. Pass through regressions.

Once the problem of disinflation at the aggregate index has been resolved, the pass-through regressions at the item level will be estimated as follows:

$$q_{it} = \frac{p_{it}}{P_t}$$

$$\Delta ln(q_{it}) = c_{0i} + \sum_{k=1}^{K}\sum_{j=0}^{L} \alpha_{ijk}\, \Delta ln\left(C_{t-j,k}\right) + \varepsilon_{it}$$

Where p_{it} is the price of the item of interest, P_t is the aggregate price index, which means that q_{it} is the relative price of the item with respect to the aggregate index. We regress $\Delta ln(q_{it})$ on a constant and lags of the log change in the commodity price index of interest. We allow for k different commodities.

The advantages of this specification are several: First, the price of the item has been seasonally adjusted before running the regression, and because we are computing relative prices as opposed to the price itself, we do not have to correct for the error-correction that is likely to appear if the price of the item and the commodity price are cointegrated. Additionally, because we have corrected by the disinflation process, the disinflation effort will not appear in the regression, so the coefficients α_{ijk}.are unlikely to suffer from spurious correlation.

The disadvantage is that the computation of impulse responses is much harder. In typical regressions we are only interested in the coefficients α_{ijk}. In general, they reflect the short run pass-through (α_{i1k}) and their sum across all lags is the long run pass-through of item *I* with respect to commodity *K*. In fact, it is usually the case that the plot the cumulative sum of these coefficients is what the researcher is trying to determine. In our case, these coefficients are the pass-through in addition to the effect the commodities have on the overall price index. Therefore, in order to compute the "correct" pass through, we have to add to the α_{ijk}.coefficients, the coefficients of the impulse response of the aggregate regression (β_{jk}). In that regression, we control for the disinflation (in that regression stochastic trends and the short term interest rates control for the disinflation effort).

$$\Delta ln(P_t) = c_0 + \sum_{k=1}^{K}\sum_{j=0}^{L} \beta_{jk}\, \Delta ln\left(C_{t-j,k}\right) + Disinf + \varepsilon_{it}$$

Therefore, the actual impulse response is for item I until period l for commodity k (I_{ilk}) is given by

$$I_{ilk} = \sum_{j=0}^{l} \alpha_{ijk} + \beta_{jk}$$

One important point should be made. For countries with low and stable inflations running the regression on the item inflation as opposed to this two step procedure produces the same result. This procedure is advantages only if there is a disinflation process that adds noise to the standard pass-through regression. Having said this, our procedure will be used for all countries regardless of their inflation history. This will allow consistent comparisons across countries and items.

IV. Results

The first step is to describe the impulse responses for the pass-through estimates for every country in the data set, for some of the selected indexes that were constructed, and for the most relevant commodities. This first part of the section is mainly descriptive and therefore concentrates on the most salient features and common patterns in the data. The second step is to explain what drives some of the properties of the pass through. This section uses all the indexes and commodities and presents a regression analysis trying to identify the factors steering the differences across countries and sectors.

A. Impulse responses

We estimated the pass-through following the methodology described in the previous section. After the estimates are obtained we simulate a one percentage change in the price of the commodity (oil, wheat, etc) and depict the impulse response for each of the indexes we are interested.

This section is mostly descriptive and concentrates on three commodities: oil, wheat, and copper. Although we take the international prices as exogenous, it is important to clarify that the literature has said that in recent years, the first one is a very good measure of the demand for energy in the world, the second one is a very good measure of the growth of the demand in emerging markets, and the third one is a very good measure of the world aggregate demand. So, in the end when we compute the impulse responses we could be just computing how the economies react to these underlying shocks.

For presentation purposes, we split the countries in either four groups: Europe (which are all the countries in Western Europe plus the USA), Emerging Europe which are mostly countries from Easter Europe. Latin America, and Asia (that includes from Israel, India, China, to Japan). Or into two groups Developed economies (which the figures still identify as Europe) and the rest of the world.

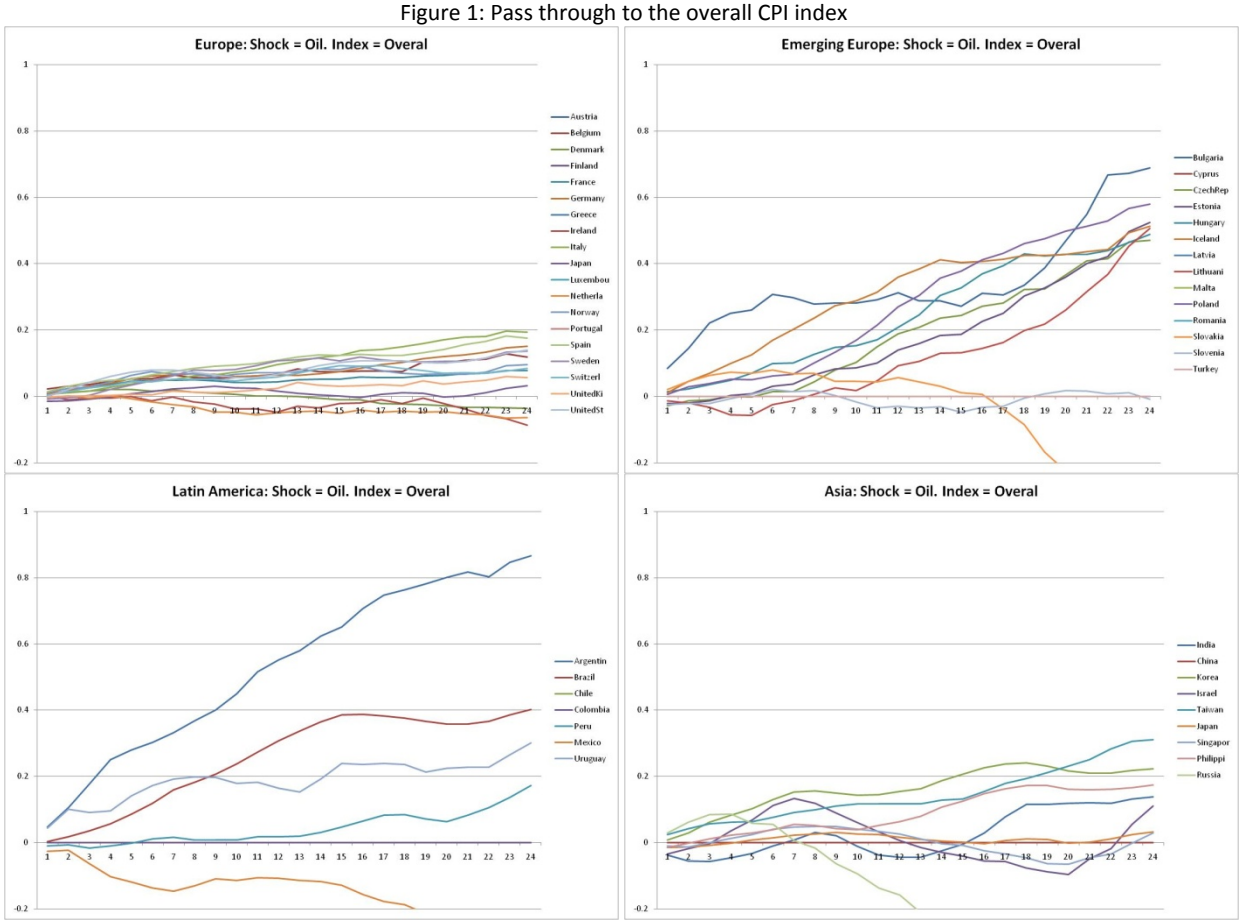
Finally, on the horizontal axis reflect the months in the impulse responses. We estimated the pass-through with 24 and 36 lags and the results are virtually identical. We are presenting here the estimated for the 24 lags specification. The impulse responses are estimated by accumulating the individual estimates.

1. Impact of Oil Price Shocks

The first step is to analyze the pass-through from oil prices to the overall aggregate price index. Remember that the price indexes have been detrended to take into account the disinflation efforts that have been underway in the past decade in Easter Europe. If the stochastic trend is not removed then an increase in oil prices implies a decline in the price level for countries such as Romania and Hungary.

In figure 1 we present the results from the estimation for the four possible groups. All the figures we present have the exact same vertical scale (from -0.2 to 1) meaning a -20 percent pass through to a maximum of 100 percent. We only present point estimates, and we present the path for each country within the groups. The title of every figure indicates the group of countries considered in the estimation, the shock, and the index.

Figure 1: Pass through to the overall CPI index



Several patterns arise from the figures that are worth highlighting. First, developed economies have a much smaller pass through and stable than other countries in the sample. All the pass-through estimates in the long run are below 20 percent, and are around 10 percent on average. Compare this estimates with Emerging Europe or Latin America, where the impulse responses usually reach long run pass-through much larger than 20 percent. Asia is in the middle where the average would be indeed 20

percent. Just for clarification, the interpretation of these coefficients is as follows. Assume there is a permanent increase in the price of oil of 10 percent, then the CPI in most developed economies will increase by roughly one percent 2 years ahead, by 2 percent on most Asian economies, and by more than that in the rest of the world.

Second, the speed of convergence to the long run pass-through is very different. Assume that we define the half life of the impulse response as the first time the impulse responses crosses half of the value of the long run pass-through. This is the equivalent of the half life estimated for AR decaying processes, except that here the decay is toward the long run pass-through. Notice that the developed economies are very slow. After one year, of the shock they are still not reaching half the long run effect. On the other hand, Latin America is the fastest.

The long run pass-through sometimes is badly estimated – because is the estimate of 24 lags. And it is always the case that estimates in the mid point are of better quality. An interesting statistic to compute in the impulse responses is the maximum of the impulse response; which sometimes occurs on month 24, but likely occurs before that. For the maximum we can compute the pass-through and its half life as well. In the appendix we present tables with the estimates of the maximum pass-through and the half lives country by country. For the CPI there is no difference, but as we will discuss in the subsequent indexes, it does make a difference for some of them.

Having analyzed the impact of oil prices on the overall index, the next step is to compute the impact of oil on the average price of gasoline, or fuels (whatever was provided).

Figure 2: Impact of oil prices on gasoline

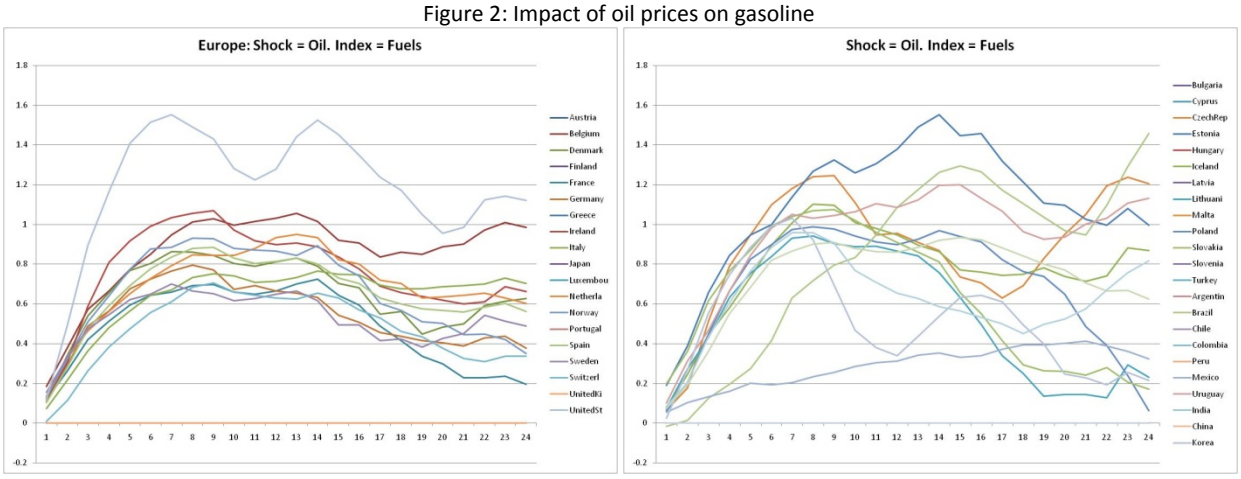


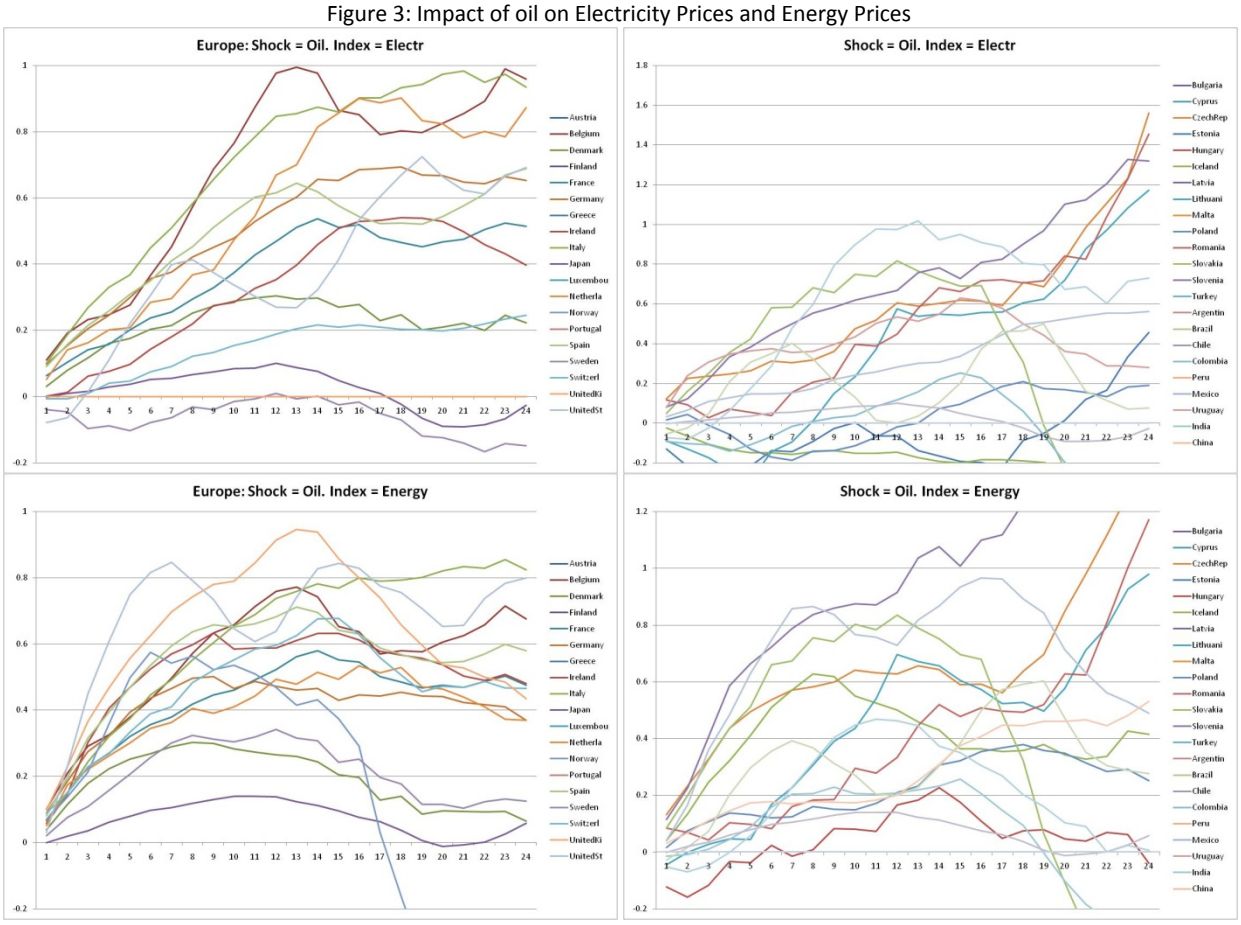
Figure 2 presents two panels, the developed economies (mostly Europe) and the developing ones. The pass-through to gasoline is remarkably stable across countries in developed economies. The pass through always picks around 9 to 12 months, and then stabilizes or declines. Also, the overall impact is very similar across countries. And importantly, the impact is very large. At the pick the pass-through

ranges from 60 percent to 100 percent: which means a 10 percent increase in the price of oil implies a 6 to 10 percent increase in the price of fuels at the pump.

Emerging markets have a much noisier estimate, but the pattern is very similar to the developed economies. Part of the noise is the outcome that in developed economies the de-trending plays no role, while in most emerging markets the de-trending of the overall index does play a role in the estimates of the individual pass-through. Nevertheless, the messages are similar. The pass-through picks at 9 to 12 months, it stabilizes or comes down since that point, and it is around 100 percent pass-through. There are exceptions, of course, but the similarities are striking. These are countries with very different market structures for the distribution of gasoline, extremely different tax systems for gasoline, some are importers and some are exporters, and the weight on gasoline consumption is extremely different across countries. Still, after going through all the filters, the impulse responses convey similar messages.

Here it can be appreciated the different conclusions that would arise if we were to concentrate on long run pass-through as opposed to the maximum.

Figure 3: Impact of oil on Electricity Prices and Energy Prices



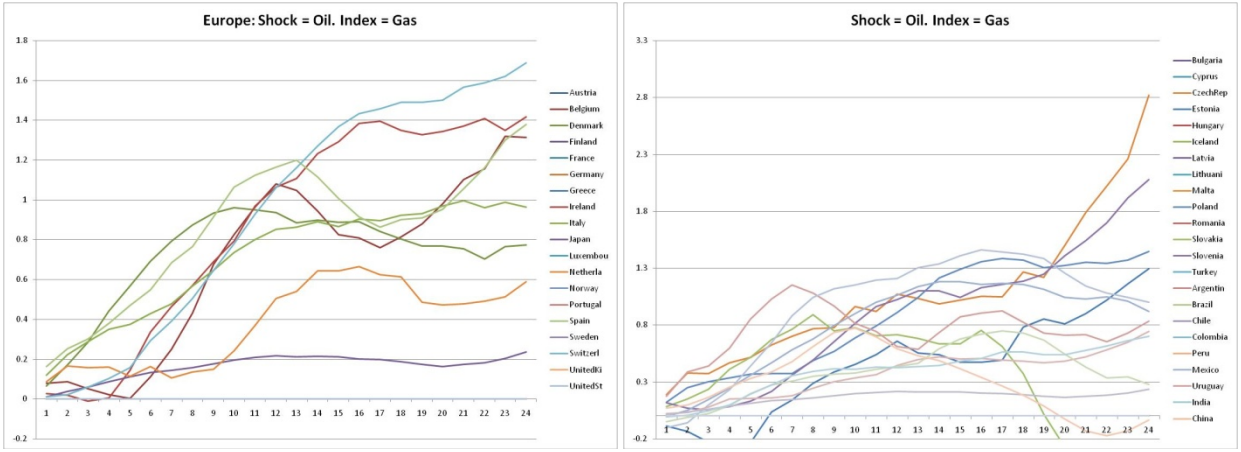
The next step is to look at the price of an energy index. We first look at the relationship between the price of oil and the price of electricity, and then we construct an index that includes all energy sources – gasoline, fuels, electricity, coal, etc. any item that is energy related was included in the energy index.

The impact of oil on electricity has less clear patterns than the ones we found before. Notice that, for example for developed economies, in some countries the pass-through is extremely large – one to one – while in others is small – 20 percent or less. The speed of convergence seems to be similar across countries but the long run pass-through is very different. One explanation for this patter is that electricity regulation might be very different across countries, and also the alternative sources of electricity might also be very different. In other words, oil and other fuels might be the marginal kilowatt of electricity is some countries, but not in others. The fact that there are different substitutes, and degrees of substitubility, across countries implies that the long run pass-through is likely to be also different.

For the rest of the world two patterns can be detected. For some countries the pass through is a "version" of the developed economies, but for others the price of electricity continues increasing for a long time. Interestingly the four countries experiencing long run divergence paths are Czech Republic, Lithuania, Romania and Slovenia. These countries have very few observations for electricity and energy and it is possible that this is the outcome of small sample biases. Nevertheless, if the pattern continues it might be interesting to understand what is the market structure and regulation in those countries that is producing such large and persistent pass-through.

The second set of panels in Figure 3 show the impulse response path of the energy index. As can be seen, it is very close to the price of electricity. It is not identical, of course, but the same patterns arise. There are long run differences that probably indicate the market structure and the type of substitutes that exist.

Figure 4: Impact of Oil Prices on the Price of Natural Gas Service in households

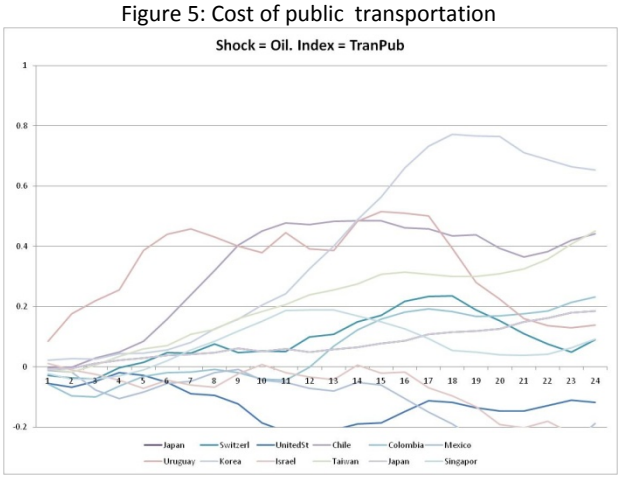


One ingredient of the energy index is the price of natural gas service to households. There is always the perception that oil price increases drive the price of household services up. Although the price of this item was not reported for all countries, some of them do have information.

In Figure 4 we present the impulse responses of the natural gas service to oil price shocks. The developed economies have relatively long data series, while the rest of the world is very short – hence, not a lot of weight should be put on the second panel responses. Nevertheless, the pass-through from oil to gas services is very large. The median maximum response in all the economies is more than 100 percent. The response is also very slow, and most countries achieve the pick after a year and a half of the shock; indicating that it takes quite some time to the price of oil to trickle down to the price of natural gas service.

In Figure 5 we present the cost of public transportation. Very few countries actually report these prices and therefore very few were included. In any case, every country that has some information was included in the regression.

Figure 5: Cost of public transportation



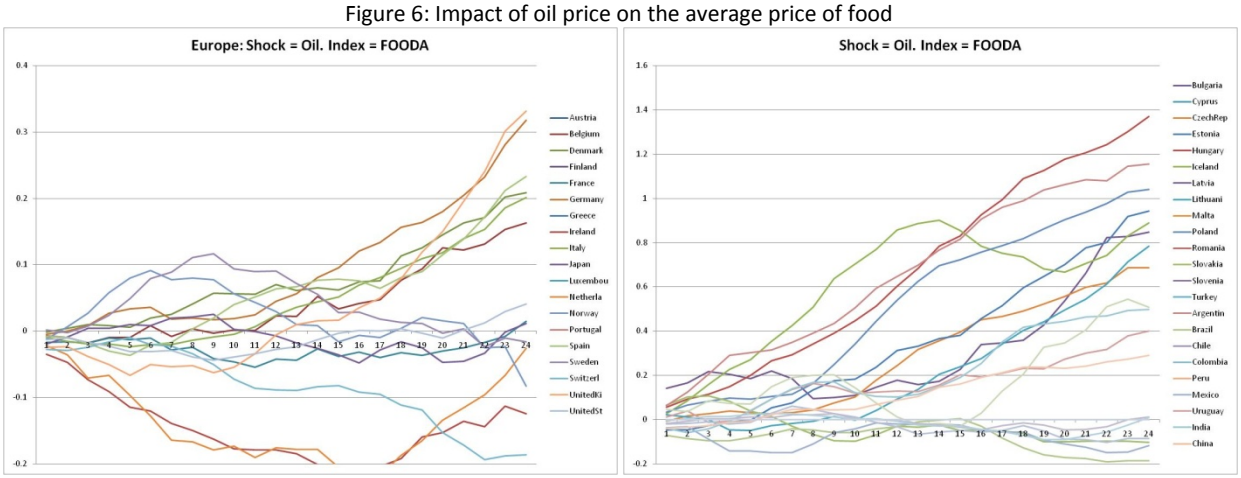
Notice that the pass through is slow and relatively large for the countries reporting. It is possible that the countries reporting transportation prices are those in which transportation prices are very sensitive in general – hence the authorities tend to pay more attention to them. In any case, it is interesting that the typical maximum pass through is about 40 percent for most countries.

Another dimension that is commonly argued on how oil prices affect inflation is through food prices. The intuition is that oil prices increase the price of transportation and therefore the price of food at retails. As we highlighted above the price of public transportation is rarely disclosed (at least to me) by the statistical offices and the price of private transportation is even less reported. However, the price of food is reported by all. So, we compute the impulse response from oil to food prices to evaluate the inflation “caused” by oil affecting transportation and everything else.

The results are presented in Figure 6. Let's start by discussing the emerging markets first. The pattern of the pass-through is certainly very interesting. All countries exhibit an almost straight line – which by the way looks very similar even when 36 lags are introduced. Countries have different long run pass-through. In this case, long run is probably a misnomer. We cannot use more than 36 lags and the patterns are identical for those as well Also interestingly, the pass-through is very large for some countries. Again, this is likely to be determined by the use of oil and fuel in the transportation of food, as well as on the types of alternative sources of transportation.

For the developed economies, Belgium, Denmark, Germany, Italy, Spain, and UK have relatively large pass-through (around 20 percent), while the rest of the countries it is close to zero. It is important to mention that in this case the estimates are not statistically different from zero, therefore, nothing huge should be raised about the patter.

Figure 6: Impact of oil price on the average price of food



In any case, the important point is that emerging markets suffer a significant pass-through, while developed economies have no impact, and for the few that have some, the effect is rather small.

So far we have used the price of oil in domestic currency. In other words, in all the previous regressions we have used the price of oi9l internationally times the exchange rate. This implies that we are measuring the destabilizing and stabilizing role of the exchange rate already in the prices. Although this is not the aim of the present paper, we thought it was illustrative to show at least some estimates when the exchange rate is excluded from the analysis. Instead of repeating all the previous figures (that can be provided if desired) we only present the CPI responses

Figure 7 presents the response of the CPI to the dollar price of oil. Compare these responses to the responses in Figure 1. First, the long run pass-through is much more different across countries and large for developed economies. Before the average pass through was below 10 percent, and all responses were relatively small, here now we have countries experiencing pass-through above 50 percent. The same can be said about the responses of emerging markets.

Second, the impulse responses are much noisier and the half lives much shorter, indicating faster convergence rates toward the long run pass-through. In the empirical analysis in the following section we spend some time studying the impulse responses from the dollar prices – in general the reactions are always noisier and larger. In other words, for most countries the exchange rate in general offers some stabilization to the external shock.

Figure 7: Impact of oil prices on the CPI when the exchange rate is not taken into account

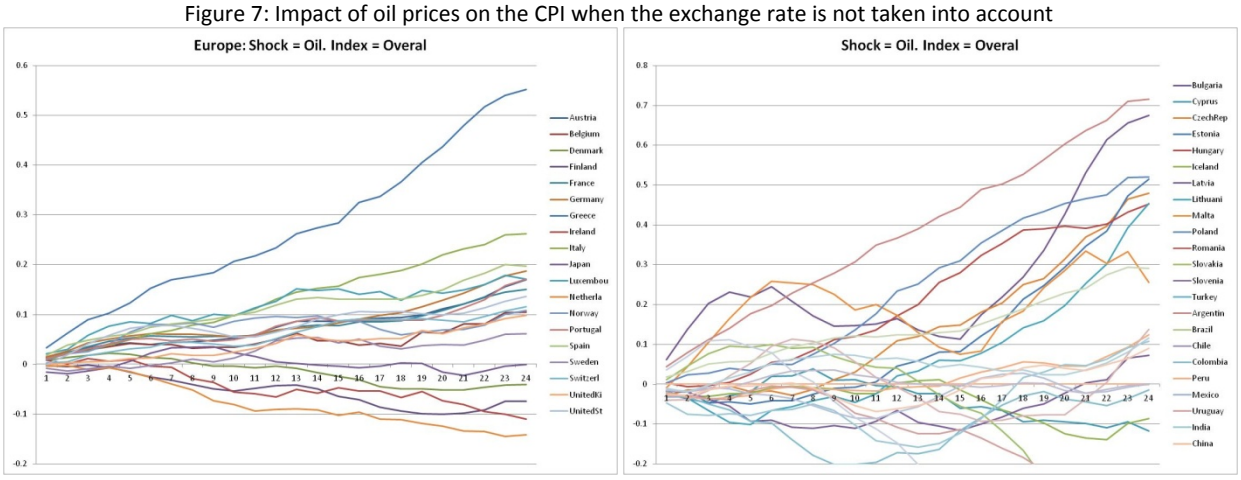
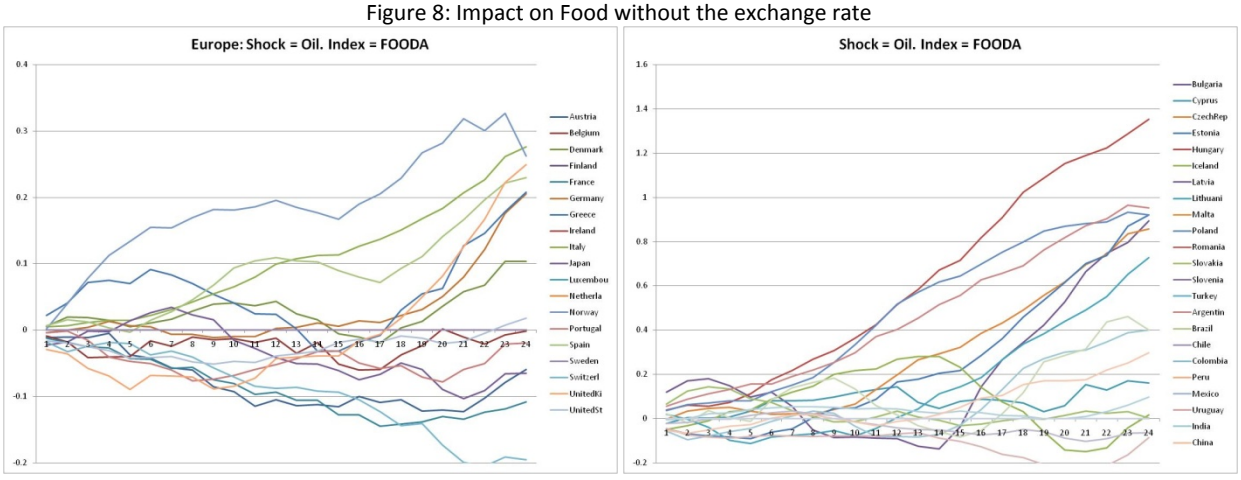


Figure 8 presents the impact on the average price of food. The exact same observations can be made in that index as well.

Figure 8: Impact on Food without the exchange rate



2. Impact of Wheat Price Shocks

Having spent the first subsection on oil, this section devotes its attention to the price of wheat. We will not present as many figures as in the case of oil, and mostly concentrate on a different set of indexes. This subsection has several messages worth highlighting at the onset. First, in the case of wheat, contrary to the case of oil, running the regressions using the dollar price or the domestic price produce

mostly identical results. The intuition is very simple if we understand that oil prices have a significant effect on the exchange rate, while wheat has a negligible effect on the exchange rate. Except, of course, for a couple of countries that are heavy wheat producers. In the right hand side of the pass-through regression we have the log price inflation rate of the commodity price. If the exchange rate is independent of the price of wheat then including or not the exchange rate on the right hand side is like including or not an orthogonal regressor. In the end, the impact is independent. The second point we present is the very slow moving effect that wheat has on everything in the economy – from the average price of food, to the price of bread.

Figure 9: Impact of Wheat prices on CPI

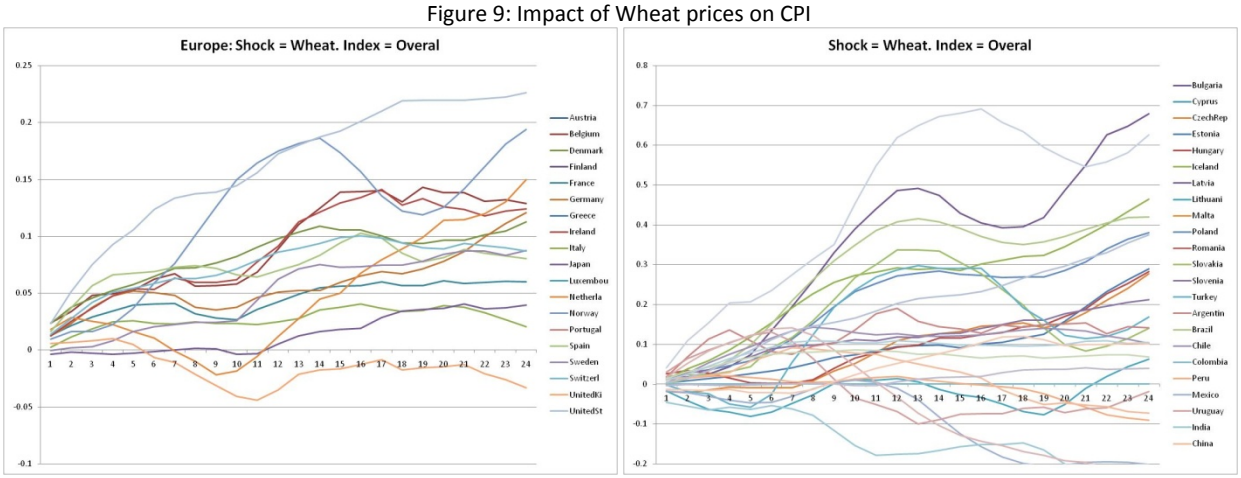


Figure 9 and Figure 10 present the impulse responses of CPI to a permanent price increase of wheat. Figure 9 is the pass-through when the price of wheat is computed in domestic currency, while Figure 10 is the pass-through for the dollar price.

It is very easy to realize the similarities in the two figures. In fact, the point estimates almost look identical – except for some minor exceptions.

The long run pass-through is very significant for developed economies – in the range of 10 to 20 percent. This implies that the price of wheat is not only capturing supply disruptions in wheat but also price increases due to aggregate demand. In other words, an increase in the world demand of wheat, increases its price and the price of all items.

Another interesting aspect is the delay in the pass-through. It takes 1 ½ to 2 years for almost all countries to incorporate the price effect into the CPI.

Finally, estimates for emerging markets are noisier, but in the end the message is similar: slow incorporating pass-through, and very large pass-through. Again, this second effect might be the outcome of partially capturing the demand effect. The next section we will discuss the case of copper. During this sample copper prices reach tremendous highs, mainly driven by demand increases. We will

see in those environments that the pass-through is very large, and can only be explained by increases in the aggregate demand.

A note on solving the problem of endogeneity in commodity prices: this is a long and standing question in the literature – how to disentangle supply disruptions with demand push. Oil has had several supply disruptions that are easily seen and reported by news outlets – and in fact, as Hamilton has shown in several papers it is almost always the case that hi pick increases are due to supply disruptions. Wheat, in recent years had a combination of the two. Certainly there where important weather patterns in the mid 2000's that created less supply of wheat in the world, but clearly the increase in prices was due to a heavy demand – especially coming from emerging markets. Copper, has had very few supply disruptions in the last 15 years – and therefore, that explains why the movement in prices have been associated with changes in the demand. This problem is extremely difficult to solve and is beyond the scope of the present paper. The purpose is to present the reduced form estimates and try to make sense of them, leaving the questions of disentangling the sources of shocks and channels to future research.

Figure 10: Impact of Wheat prices on CPI without the exchange rate effect

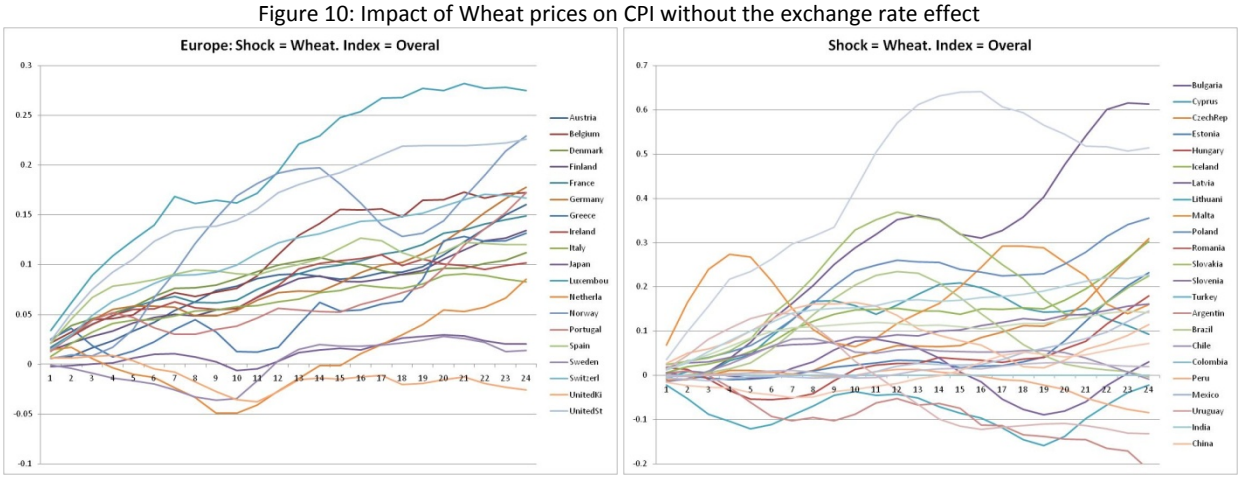


Figure 10 presents the estimates using the dollar price. Notice the tremendous similarities with the previous figure.

Wheat is a significant component of food, and also is associated with the demand for food. Hence, evaluating the pass-through from wheat prices to the food index reflects the strength of these channels. Figure 11 presents the results of the pass-through from wheat to food. We use the local price of Wheat in these regressions.

First, there is a relatively large pass-through in developed economies, and a very large long run pass through for emerging markets. One is close to 20 percent, while the other is close to 100 percent. it is hard to rationalize these estimates if we are thinking about a supply shock to wheat. These numbers have to take into account that an increase in the demand for food increases all food prices, and by transitivity increasing the price of wheat.

Second, the pass-through is very slow moving – again as in the case of the CPI it takes almost the whole sample to reach the long run pass-through. As in the case of Oil, the estimates of the half lives and maximum pass-throughs are presented in the tables in the appendix.

Figure 11: Impact of Wheat Prices on the Average price of food

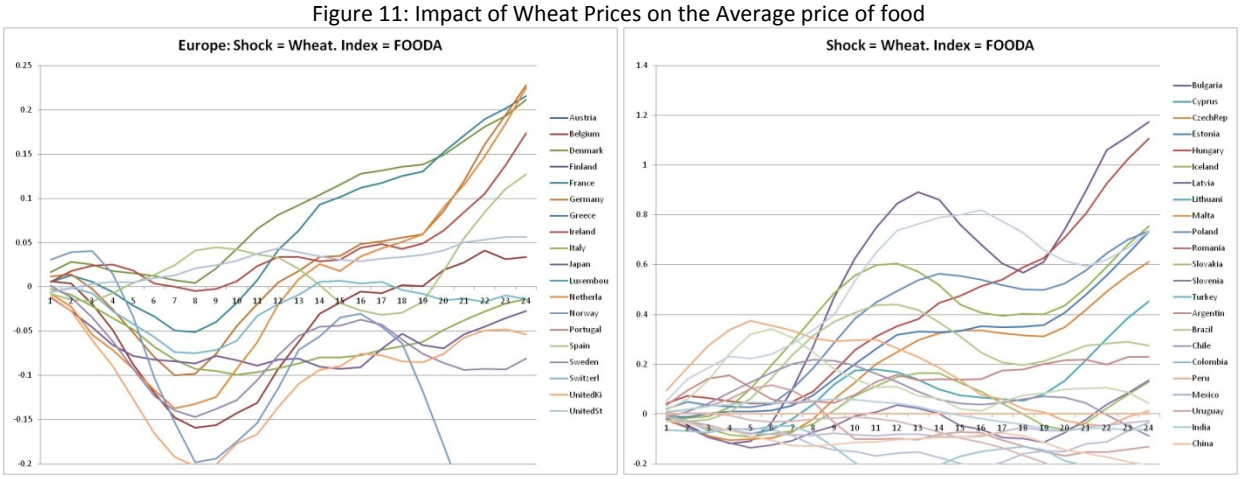
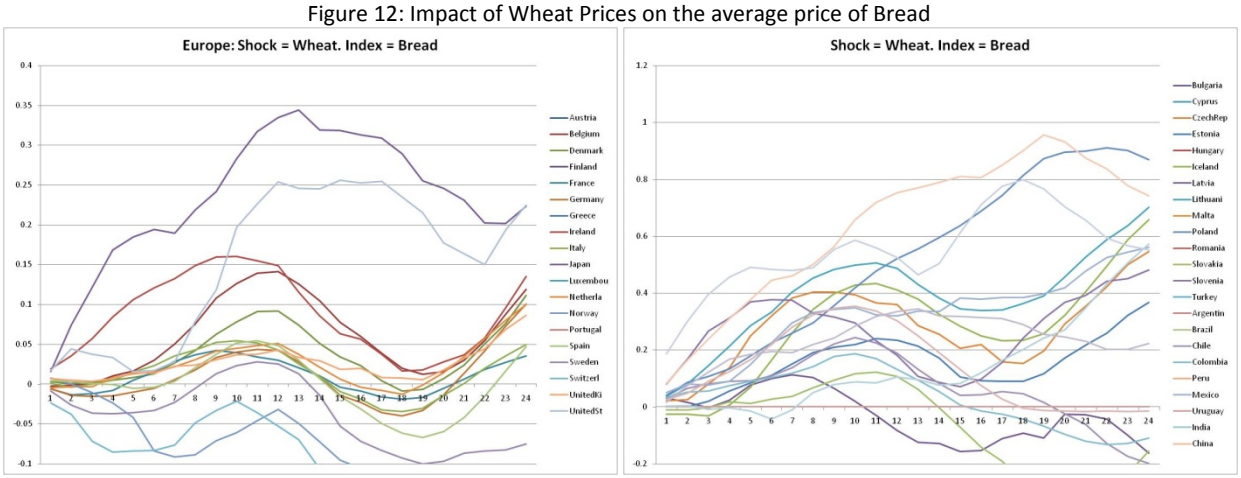


Figure 12: Impact of Wheat Prices on the average price of Bread



Instead of looking at the price of food we can concentrate on the price of bread, cereals and flour. Not all countries report the price of bread, but combining bread cereals and flour in a single index we were able to include several countries in the analysis.

The pass-through results are presented in Figure 12. Notice that the pass-through moves much faster than CPI or food. In fact, for developed economies the pass-throughs are much smaller – the maximum for all countries except 2 is 15 percent. Similarly for emerging markets, the maximum is around 60 percent (except for 4 or 5 countries).

Second, the maximum occurs much sooner than food and CPI. In fact, in most cases, the price reaches its maximum in month 8 to 12, with half-lives of less than 6 for almost all of them. In other words, prices of bread are reacting very fast in comparison to food and the CPI in general.

3. Impact of Copper Prices Shocks

Having discussed the case of oil and wheat, we decided to devote some time to the case of copper. The reason is that the price of copper can be interpreted as world demand, as opposed to supply disruptions in copper. So, even though we will run the regression using the copper price we can interpret these impulse responses as consumer demand increasing.

Figure 13 presents the impact of copper on the CPI. We also present the impact on Energy, Clothing, Communications, Electricity and other household services, and Housing. These are figures 14 to 18 (all presented below).

Figure 13: Impact of Copper on the CPI.

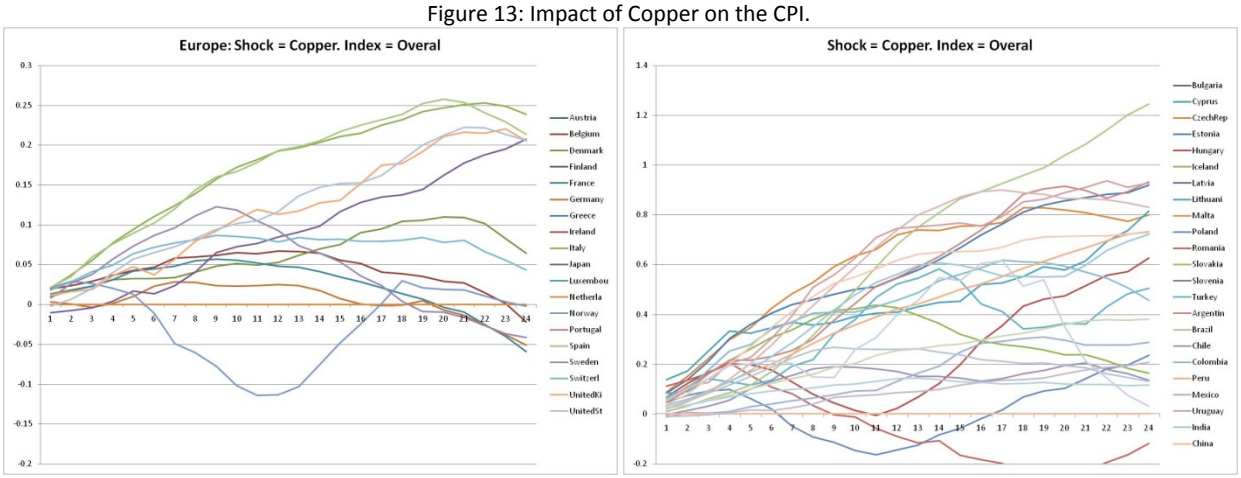


Figure 14: Energy

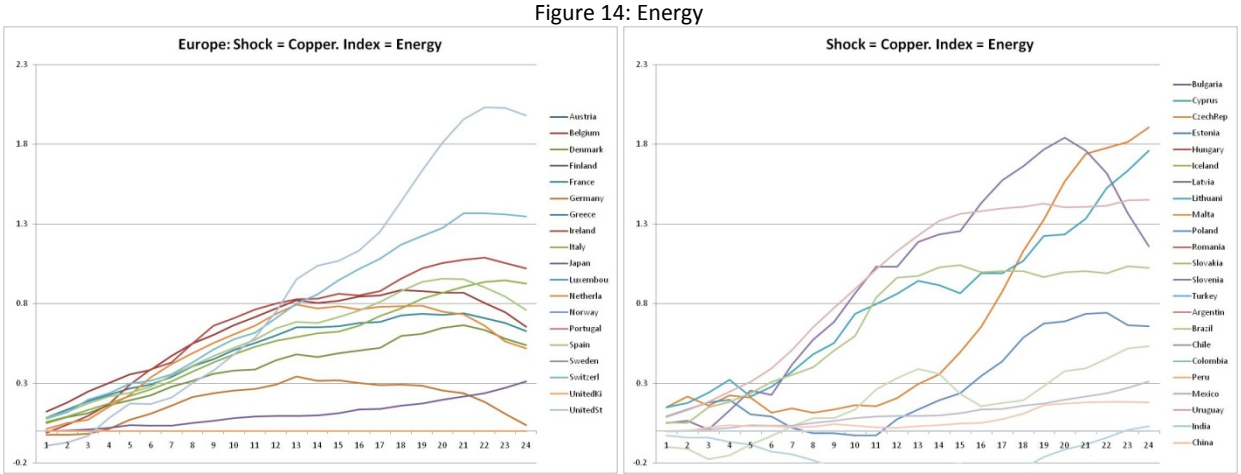


Figure 15: Clothing

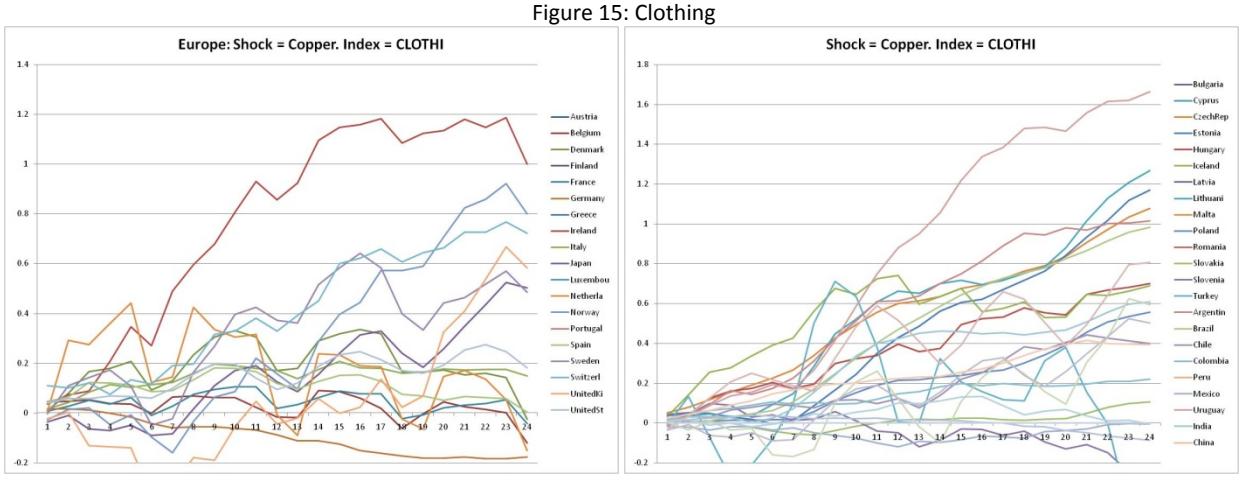


Figure 16: Communications

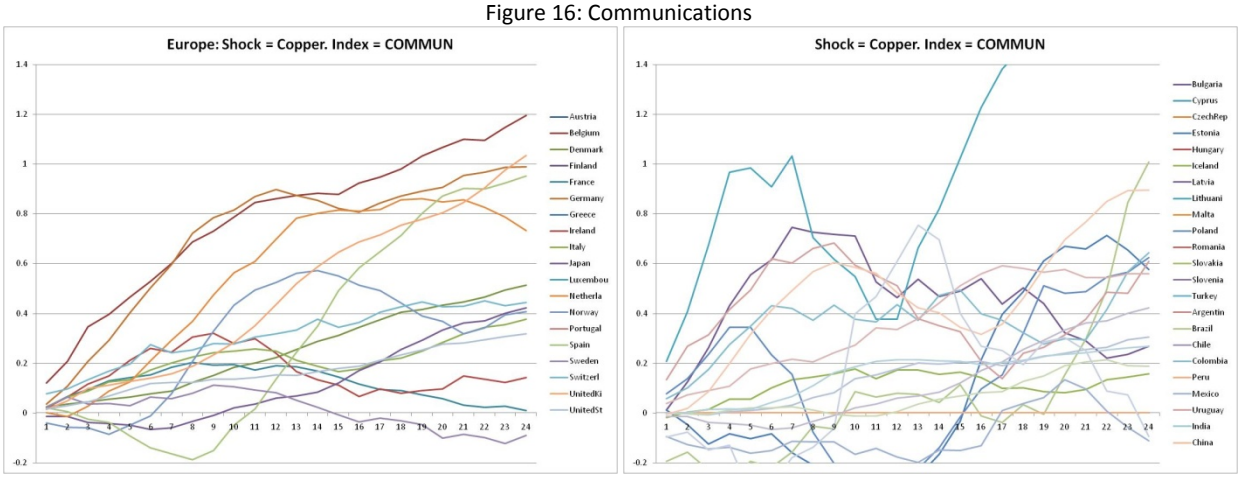


Figure 17: Electricity

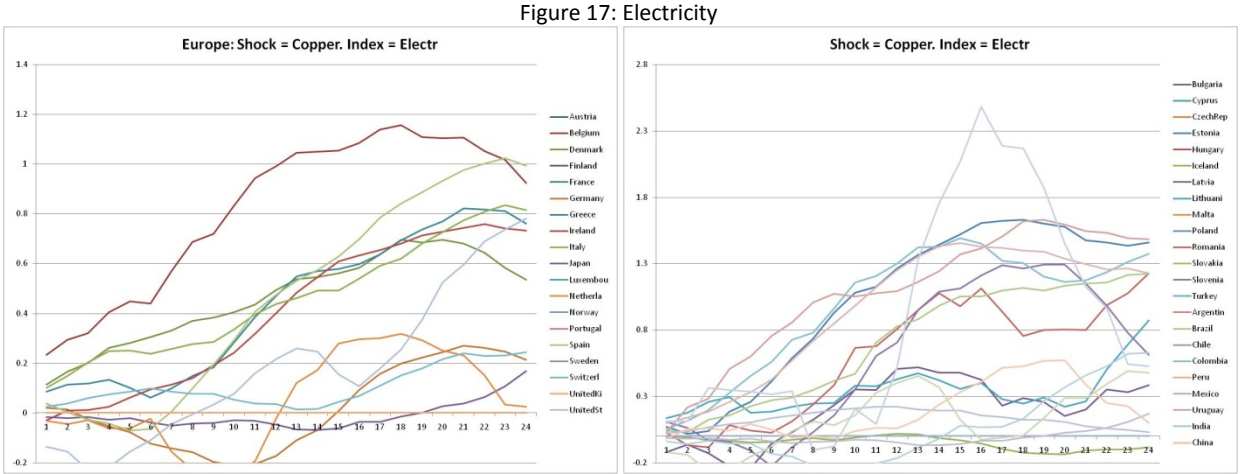
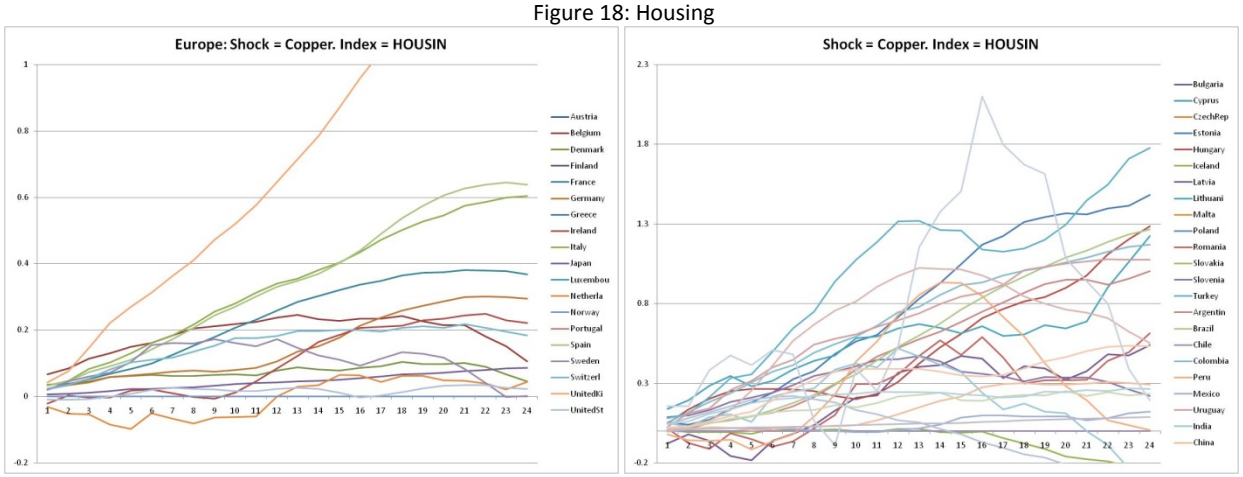


Figure 18: Housing



Independently of the index chosen we can detect several interesting patterns. In developed economies pass-through estimates are very slow. This is similar to the implications we would have obtained from estimating monetary policy shocks in these economies. Prices always tend to move slowly reaching the long run equilibrium two years later. All the figures show the same characteristics, or convey the same message.

A demand shock (copper) to these economies implies an increase in prices that takes roughly 20 to 24 months to be incorporated fully. From all the sectors, energy moves the fastest, while housing and communications move the slowest.

Emerging markets have much noisier estimates – again a product of the "cleaning" of the disinflation effort – but they seem to move faster than the developed economies. The same pattern arises: energy is the fastest and housing the slowest.

The second dimension is the level of the pass-through. As has been a common theme in this discussion, the pass-through to developed economies is much lower than developing economies.

For developed countries, tThe pass-through to the CPI is about 20 percent (the maximum), while it is 80 percent for energy, 60 percent for clothing, and 40 percent for housing. For emerging markets the all move about 100 percent!

B. Regression Analysis and Variance Decomposition

The previous section has described the impulse responses in the data. It highlights some of the interesting features and cross country comparisons. However, it is mostly a description of what occurs. In this section we want to go further and try to understand the factors determining the cross country similarities and differences.

In this section we would like to perform a variance decomposition trying to understand which factors describe the responses. For example, is it country characteristics or sectorial properties what drive the

impulse responses we observe. In order to do so we proceed in the following manner. We describe the impulse responses by four statistics. The first two are related to the pass through: The level of the pass-through in the long run, and the maximum pass-through in the impulse response. The other two are related to the speed at which the pass-through is achieved: the half life to the maximum and the long run pass-through.

The exact definitions are the following. For each impulse response, the long run pass-through is the level of the pass through that prevails in period 24 (which is the longest lag we computed in the previous section). Of course, there is a confidence interval for the estimate and we also compute it. The half life for the long run pass through is computed as the number of months that take the impulse response to reach half of the long run pass-through level. We look at the first time the impulse responses crosses the threshold. This is a measure of how fast the economy converges to the long run. Of course, there is also a confidence interval in the estimation of the half life – which needs to be computed by bootstrapping the residuals (more on this below). The other measures instead of computing the long run pass-through compute the maximum of the impulse response. The maximum usually occurs before month 24 and in general it is much better estimated – in the sense that the confidence interval is tighter. Finally, the half life to the maximum is computed in a similar fashion as the long run half life: we find in which month the impulse response reaches half of the maximum for the first time.

The computation of the confidence intervals requires the use of bootstrapping. To simplify the description of the methodology lets assume there is no aggregate disinflation. The idea is the following: Estimating the MA specification

$$\Delta ln(P_t) = c_0 + \sum_{k=1}^{K}\sum_{j=0}^{L} \beta_{jk}\, \Delta ln\left(C_{t-j,k}\right) + \varepsilon_{it}$$

Provides estimates of c_0 and β_{jk}. From this estimates we compute the impulse response as a simple sum of the β_{jk} for a given *k*. In that impulse response we compute the long-run pass through, its half life, the maximum and its half life. Because the residuals are supposed to be i.i.d., we bootstrap the ε_{it} and using the original estimates we create a new series of $\Delta ln(P_t)$. We re-estimate the coefficients using the constructed series – which provides another long run pass-through, maximum, and half lives. We repeat the procedure 500 times and obtain a distribution of our four statistics. We do that for each series, each country, and each commodity shock.

In practice we have another layer of estimation – which is the aggregate index – but the intuition is similar. The idea is to get a series of estimates for the aggregate and each relative price and construct our four statistics on the impulse responses.

Having estimated the statistics and their respective confidence intervals, we are ready to run a simple regression in which we disentangle the country and sectoral explanatory power. Because countries and sectors are not independent variables – they are not orthogonal in the data – the variance decomposition cannot proceed in the usual manner. To clarify the estimation lets concentrate on the maximum pass through.

Assume we are have the estimates of the maximum for country *c* and sector or index *i* (denote them by m_{ci}) for an oil shock. In other words, m_{ci} are the estimates for every country and every sector that has valid data to an oil shock. For each one of these estimates we have their distribution – whose standard deviation we use to correct the estimation. The first step is to compute how much the country fixed effect explains. We estimate a simple regression of m_{ci} on country dummies.

$$m_{ci} = c_c + \varepsilon_{ci}$$

Where c_c are the country dummies. In the estimation we use the standard deviation of the estimates of m_{ci} to correct for the heteroskedasticity. In other words, if one m_{ci} is extremely badly estimated we want to put very little weight on that observation. The Rsquare of this regression is actually the explanatory power of the country dummies. In fact, this is the highest possible explanatory power we can give the countries.

In the second step, we add to the regression the sectoral dummies

$$m_{ci} = c_c + c_i + \varepsilon_{ci}$$

Where c_i are the sectoral dummies (we leave the aggregate index without a constant). Notice that now the Rsquare of this regression is the explanatory power that both the sectors and countries have. By subtracting the previous Rsquare from this one we obtain the contribution of the sectorial effects. Obviously, this procedure maximizes the explanatory power of the country effects. Doing the reverse order would have maximized the sectors effect. The results are different, but the qualitative message is the same – in the end the sectorial effects are quite significant. We will highlight this general message, and therefore, in this presentation only the results from the procedure that maximizes ther country effect is presented – that is the most negative one for the point that is emphasized.

In the next table the variance decomposition for the impulse responses from the commodities in local prices is presented. Several commodities are analyzed: oil, rice, maize, wheat and copper. For each statistic, maximum pass through, maximum half life, long run pass through, and long run half life, we present the contribution of the country fixed effects (first column), the sectorial fixed effect (second column) and the total. For each commodity we run a separate regression.

TABLE 2
Variance Decomposition of Country fixed effect, and Sector fixed effects.
Commodity prices in local prices

Commodities in Local Prices						
	Max Pass Through			Max Half Life		
Shock	Country	Sector	Total	Country	Sector	Total
Oil	36.2%	25.4%	61.6%	33.9%	16.8%	50.7%
Rice	21.8%	32.1%	53.9%	8.3%	21.9%	30.2%
Maize	47.9%	15.5%	63.4%	20.2%	14.4%	34.6%
Wheat	49.4%	15.4%	64.8%	20.1%	14.8%	34.9%
Copper	16.5%	41.0%	57.5%	10.9%	27.8%	38.7%
	LR Pass Through			LR Half Life		
Oil	22.7%	29.1%	51.8%	32.5%	17.5%	50.0%
Rice	22.0%	27.5%	49.5%	7.8%	18.5%	26.2%
Maize	40.1%	13.6%	53.7%	24.2%	18.8%	42.9%
Wheat	39.1%	15.2%	54.3%	23.8%	19.7%	43.5%
Copper	8.5%	37.9%	46.4%	11.1%	29.0%	40.1%

We first study the impact of the commodity in local currency – hence the effect of the exchange rate is included – and in the following table we present the results for the dollar price of the commodities.

Several points are worth highlighting. First, the overall explanatory power of the fixed effects is quite significant for pass through. Roughly 50 to 60 percent of the variation is accounted for the fixed effects. For the half lives, however, the average explanatory power is about 30 to 40 percent.

Second, sectorial fixed effects explain a significant proportion of the variation. My prior was that country effects was going to swamp all the variation. My intuition was that the pass-through depended on monetary and fiscal policy reactions, as well as degree of competition, institutions, credibility, degree of stickiness, etc. Most of the literature has highlighted how different these effects are across countries, and how different the pass through estimates are. Hence, i was expecting a very small percentage of the variation to depend on sectoral characteristics – after taking country effects out of the picture. The results prove wrong this intuition. Even after controling for country effects the sector effect is more than 15 percent – which means that 1/3 of the explained variation is at least explained by the sectoral effect. For copper and oil the effects are even larger – for these commodities the sectorial effect on the pass-through is at least half of the total explained variation.

Third, even more suprprising is the fact that for all commodities the sectorial effect is almost always ½ of the explanation for the half lives. In other words, irrespectively of how we measure the speed of the pass through – long run or maximum – the sectoral effect is about ½ of the total explained variation. In fact, in the decomposition for the long run it is always more than half the explained variation.

What is the interpretation? My reading of the evidence is that the dispersion of pass through within an economy is mostly explained by characteristics that are “natural” to the sectors; use of the commodity in the production, procedures and channels of distribution, “natural” markups of the sector, “natural”

substitubility of the items, etc. These factors are constant across countries. In general, we assign a significant proportion of the pass-through behavior to country characteristics – inflation, monetary policy, fiscal policy, degree of competition, taxes, etc. certainly these factors are important, by no means I am dismissing their role. But this cross country comparison is allowing us to have a different view of the problem and realize that several important determinants of pass-through have not being considered enough in the literature – and policy and practical work.

TABLE 3
Variance Decomposition of Country fixed effect, and Sector fixed effects.
Commodity prices in Dollars

Commodities in Dollars						
	Max Pass Through			Max Half Life		
Shock	Country	Sector	Total	Country	Sector	Total
Oil	27.0%	26.8%	53.7%	32.3%	17.0%	49.3%
Rice	24.7%	22.8%	47.5%	8.3%	19.1%	27.4%
Maize	55.4%	11.4%	66.7%	19.7%	18.0%	37.7%
Wheat	56.5%	11.8%	68.3%	19.6%	16.3%	35.8%
Copper	26.3%	27.1%	53.4%	29.8%	10.8%	40.6%
	LR Pass Through			LR Half Life		
Oil	18.4%	27.5%	46.0%	33.4%	18.8%	52.2%
Rice	23.4%	19.0%	42.5%	6.1%	20.8%	27.0%
Maize	50.8%	10.8%	61.5%	19.3%	20.1%	39.3%
Wheat	51.4%	11.3%	62.7%	20.5%	18.0%	38.6%
Copper	23.1%	23.8%	46.8%	24.4%	11.3%	35.7%

One interesting exercise is to leave the exchange rate out of the pass-through analysis. In other words, lets re-compute all impulse responses from the dollar price of the commodity and perform the same variance decomposition. The results are presented ion Table 3.

Notice that now the country fixed effect is much more important than the sectorial fixed effect. For some commodities, the country effect is above 50 percent of the va4riation, while the sectors exaplin about 10 percent. In fact, ion this exercise the sector effect is always less than 30 percent and for almost all the cases is between 10 to 20 percent. A much smaller percentage of the total variation, and a smaller share of the total explained variation.

This makes sense because indeed the reaction of the exchange rate – that for some countries is a stabilizing force, while for others is a destabilizing force – is clearly country specific. The variation is reflecting this very simple aspect. As a reminder, for some countries, a price increase in the commodity implies a depreciation, making the local price of the commodity to increase beyond the dollar shock – for other countries, the increase in the commodity price produce an appreciation (for most of the commodity producers) and hence, the local price increases by less than the international price.

One final point in this section is to justify why we used fixed effects as opposed to other variables. First, our exercise is entirely cross-sectional (cross-sectoral); hence, time variation plays no role. Second, it was impossible to find country variables that remotely approximate the explanatory power of the fixed effects. We tried several country variables – such as GDP, average inflation, financial development, quality of institutions, etc. in the end, the one that performed the best was GDP per capita. The results are presented in the following table.

TABLE 4
Variance decomposition for GDP per capita.

	Commodities in Local Prices			Commodities in Dollars	
	Max PT	Max HL		Max PT	Max HL
Shock					
Oil	7.0%	4.0%	Oil	3.9%	4.3%
Rice	10.9%	0.3%	Rice	6.6%	0.6%
Maize	2.6%	0.0%	Maize	0.7%	0.0%
Wheat	2.4%	0.0%	Wheat	0.1%	0.1%
Copper	14.5%	1.8%	Copper	7.1%	0.1%
	LR PT	LR HL		LR PT	LR HL
Oil	6.0%	3.1%	Oil	2.4%	4.9%
Rice	8.7%	0.0%	Rice	4.3%	0.3%
Maize	1.3%	0.0%	Maize	0.0%	0.0%
Wheat	1.2%	0.0%	Wheat	0.1%	0.1%
Copper	12.1%	0.6%	Copper	3.6%	0.4%

Notice the tiny explanatory power of this variable. This is the maximum that GDP per capita can explain and it is a small fraction from what the fixed effects are explaining. This means that there are important country differences that are not captured – and not even correlated – with GDP per capita. And inflation, institutions, etc. It is not clear which variables should be included, but clearly, the ones used – even in tandem – are not enough.

V. Conclusions

The present paper has used unique micro price data to estimate the pass-through from commodity prices to items and indexes for several countries. This paper is mainly reporting some stylized facts found in the data regarding the type of impulse responses and argues that sectoral characteristics are a significant source of the observed variation in the data.

It should have been expected that countries respond differently to the different shocks; and that sectors respond differently across countries and commodities. Nevertheless, a third of all the explained variation is driven by sectoral characteristics. Most of the literature has disregarded this dimension. This is due to several reasons: first, for a given country it is rare to compute pass-through to different sectors. Second, rarely, we compare pass-through across two countries, and when that has been done it

has been performed on the aggregate CPI. Therefore, the decomposition presented here could have not been performed. Because the analysis in the literature has been either one country at a time, and several countries but one sector at a time, the implication has been that country differences is what dominates the discussion. The results presented in this paper are challenging this common approach. This is a first step and certainly future research should continue to look into this decomposition further.

The second innovation in this paper is that instead of using exchange rates as the source of shock we have used commodity prices. This is interesting by itself, but the reason is that for most of these countries the movements in commodity prices is exogenous to local characteristics.

Although this is advantageous, there is one important challenge that commodity prices entail. It is difficult to understand how much of the shock is due to supply disruptions of the commodity and how much due to world demand. We study three commodities that clearly have different degrees in this mixture. Oil, although it has a strong demand component, supply disruptions are very frequent and important short run movement is due to clashes in Venezuela, Nigeria, and the war in Iraq. Wheat, has had some supply disruptions in the last 10 years due to important weather patterns, however, the price of wheat increased considerably due to excess demand in emerging markets. Finally, copper is perhaps the commodity that has suffered less supply problems in the last 15 years and therefore, its price can be considered mostly world demand. The distinction between wheat and copper in terms of demand, is that wheat is mostly demanded in food or processed food – something likely to increase by India and China increasing its consumption – while copper is lead by electronics and high end manufacturing products – something likely to be driven by excess demand in rich nations.

In this paper we have not disentangle the sources of the commodity price movements. Indeed, solving the problem of endogeneity is not trivial at all. Future research should look into this and incorporate the disentangling of the supply versus demand shocks into the present pass-through analysis.

VI. Tables

TABLE A1
Estimates for Oil Shocks on CPI Index
Oil in local currency

	Max	HL (max)		Max	HL (max)
Belgium	13%	7	Iceland	51%	9
Denmark	2%	2	Lithuania	51%	20
France	8%	5	Poland	58%	13
Germany	15%	16	Slovakia	8%	2
Ireland	0%	1	Slovenia	2%	6
Italy	20%	13	Argentina	87%	10
Japan	3%	7	Brazil	40%	9
Netherlands	0%	2	Peru	17%	22
Norway	10%	5	Uruguay	30%	6
Spain	18%	10	India	14%	17
Sweden	14%	8	Korea	24%	6
Switzerland	9%	7	Israel	13%	5
UK	6%	13	Taiwan	31%	17
USA	14%	5	Japan	3%	7
Bulgaria	69%	19	Singapore	5%	5
Czech Republic	47%	14	Philippines	17%	14
Estonia	52%	18	Russia	9%	2
Hungary	49%	13			

TABLE A2
Estimates for Oil Shocks on Energy Index
Oil in local currency

	Max	HL (max)		Max	HL (max)
Belgium	77%	6	Czech Republic	146%	20
Denmark	30%	3	Hungary	23%	12
France	58%	5	Iceland	63%	4
Germany	50%	3	Lithuania	98%	11
Ireland	63%	4	Poland	38%	12
Italy	85%	6	Romania	117%	20
Japan	14%	5	Slovakia	83%	4
Netherlands	53%	5	Slovenia	181%	12
Norway	57%	4	India	26%	6
Spain	71%	4	Korea	97%	4
Sweden	34%	5	Taiwan	60%	6
Switzerland	68%	6	Japan	14%	5
UK	95%	5	Singapore	47%	8
USA	85%	3	Philippines	53%	14

TABLE A3
Estimates for Oil Shocks on Gasoline Average Prices
Oil in local currency

	Max	HL (max)		Max	HL (max)
Belgium	105%	3	Estonia	155%	4
Denmark	86%	3	Iceland	110%	4
France	72%	3	Lithuania	94%	4
Germany	79%	3	Poland	99%	4
Ireland	107%	3	Romania	29%	4
Italy	77%	4	Slovakia	107%	3
Netherlands	95%	4	Brazil	146%	9
Norway	93%	3	Mexico	41%	8
Spain	89%	3	Uruguay	120%	4
Sweden	70%	3	Korea	103%	3
Switzerland	70%	4	Taiwan	93%	4
USA	155%	3	Singapore	96%	4
Czech Republic	125%	4	Philippines	94%	3

TABLE A4
Estimates for Oil Shocks on Natural Gas Average Prices
Oil in local currency

	Max	HL (max)		Max	HL (max)
Belgium	132%	9	Slovakia	89%	5
Denmark	96%	5	Slovenia	208%	13
Ireland	142%	10	Mexico	118%	8
Italy	100%	8	Uruguay	115%	4
Japan	24%	6	Korea	146%	7
Netherlands	66%	11	Israel	74%	12
Spain	138%	8	Taiwan	75%	10
Switzerland	169%	11	Japan	24%	6
Czech Republic	282%	20	Singapore	70%	7
Estonia	129%	12	Philippines	77%	7
Poland	144%	11			

TABLE A5
Estimates for Wheat Shocks on CPI Index
Wheat in local currency

	Max	HL (max)		Max	HL (max)
Belgium	14%	12	Lithuania	6%	23
Denmark	11%	5	Poland	38%	9
France	6%	4	Slovakia	34%	9
Germany	12%	16	Slovenia	21%	10
Ireland	14%	11	Turkey	30%	9
Italy	4%	4	Argentina	19%	3
Japan	4%	17	Brazil	42%	8
Netherlands	15%	17	Chile	14%	4
Norway	19%	8	Peru	2%	2
Spain	10%	3	Mexico	1%	10
Sweden	9%	12	Uruguay	13%	3
Switzerland	10%	4	China	9%	5
UK	1%	1	Korea	37%	12
USA	23%	6	Israel	14%	3
Bulgaria	68%	10	Taiwan	9%	4
Czech Republic	28%	16	Japan	4%	17
Estonia	29%	20	Singapore	11%	4
Hungary	28%	18	Philippines	12%	13
Iceland	46%	9	Russia	69%	9

TABLE A6
Estimates for Wheat Shocks on CPI Index
Wheat in DOLLARS

	Max	HL (max)		Max	HL (max)
Austria	16%	11	Czech Republic	31%	21
Belgium	17%	11	Estonia	23%	21
Denmark	11%	5	Hungary	18%	22
Finland	13%	12	Iceland	30%	18
France	15%	11	Latvia	8%	9
Germany	18%	16	Malta	29%	2
Greece	13%	19	Poland	36%	9
Ireland	11%	5	Slovakia	37%	8
Italy	9%	7	Slovenia	16%	10
Japan	3%	15	Argentina	1%	2
Luxembou	28%	7	Brazil	23%	8
Netherlands	9%	20	Chile	8%	5
Norway	23%	8	Peru	1%	11
Portugal	17%	20	China	17%	5
Spain	13%	3	Korea	14%	21
Sweden	3%	13	Israel	14%	3
Switzerland	17%	7	Taiwan	14%	5
UK	1%	1	Japan	3%	15
USA	23%	6	Singapore	23%	6
Bulgaria	62%	11	Philippines	7%	17
Cyprus	21%	7	Russia	64%	9

TABLE A7
Estimates for Wheat Shocks on Bread Average Prices
Wheat in local currency

	Max	HL (max)		Max	HL (max)
Belgium	8%	9	Iceland	94%	9
Denmark	3%	10	Lithuania	14%	6
France	4%	7	Poland	89%	13
Germany	3%	24	Slovenia	49%	4
Ireland	17%	5	Chile	94%	7
Italy	2%	9	Colombia	29%	6
Japan	24%	5	Israel	58%	6
Netherlands	9%	23	Japan	24%	5
USA	8%	12	Singapore	117%	18
Bulgaria	70%	5	Philippines	39%	9
Czech Republic	60%	21	Russia	34%	2
Estonia	28%	21			

TABLE A8
Estimates for Wheat Shocks on Food Index
Wheat in local currency

	Max	HL (max)		Max	HL (max)
Belgium	4%	21	Iceland	76%	8
Denmark	21%	15	Lithuania	45%	22
France	22%	16	Poland	74%	10
Germany	23%	21	Slovakia	16%	11
Ireland	17%	22	Slovenia	14%	23
Netherlands	22%	21	Argentina	23%	3
Spain	13%	22	Brazil	44%	7
Switzerland	1%	14	Chile	22%	5
USA	6%	10	Peru	37%	3
Bulgaria	117%	10	Uruguay	12%	4
Czech Republic	61%	14	Taiwan	34%	4
Estonia	73%	20	Singapore	6%	3
Hungary	111%	18	Russia	82%	10

VII. References

Bils and Klenow (2004),

Gopinath and Rigobon (2008 and 2009),

Kehoe and Midrigan (2007),

Klenow and Kryvtsov (2008),

Lach and Tsiddon (1996),

Nakamura and Steinsson (2007),

Klenow and Willis (2006)

Gomez and Maravall (1997)