

Macroeconomic policy, inflation and deindustrialization in a dual economy ^{*}

Guilherme Klein Martins (University of Massachusetts Amherst) [†]
Peter Skott (University of Massachusetts Amherst)

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Abstract

This paper presents a model of inflation in developing economies. We see cross-sectoral interactions between demand and supply side forces as central to prices dynamics and show that the standard macroeconomic policy recommendations of inflation targeting and balanced budgets (i) increase volatility by amplifying external shocks and (ii) can lead to premature deindustrialization. The Brazilian experience since 2000 is used to illustrate the argument, but the analysis applies more widely to developing and emerging market economies.

JEL codes: E63, O23, O14

Key words: inflation targeting, overvaluation, commodities boom, Washington consensus

Resumo

O artigo apresenta um modelo de inflação em economias em desenvolvimento. Argumentamos que interações intersetoriais entre forças de demanda e oferta são centrais para a inflação e mostramos que as recomendações macroeconômicas convencionais de equilíbrio orçamentário e metas de inflação (i) aumentam a volatilidade da economia ao amplificar choques externos e (ii) podem levar a um processo de desindustrialização prematura. A experiência brasileira desde 2000 é usada para ilustrar o argumento, mas a análise se aplica mais amplamente para países subdesenvolvidos e emergentes.

JEL codes: E63, O23, O14

Palavras-chave: metas de inflação, sobrevalorização cambial, boom de commodities, consenso de Washington

Área 6 - Crescimento, Desenvolvimento Econômico e Instituições

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[†]gmartins@umass.edu

1 Introduction

Why do economies with large amounts of hidden unemployment and underemployment experience inflationary pressures? Standard economic theory relates inflation to deviations of the actual unemployment rate from its structural and frictional levels. But the notion that labor constraints and deviations from a "natural rate" of unemployment generate inflation and limit economic growth in developing economies would seem hard to defend.

Our analysis of inflation in dual economies has strong affinities with the Latin American structuralist tradition.¹ Like the structuralist school we focus on social conflict, inertia related to formal and informal indexation, and interactions across sectors.

We see inflation in a dual economy as deriving from the sectoral interactions between demand and supply side forces. Incomes in the informal sector of the economy are demand determined. Shocks to aggregate demand therefore influence relative incomes, and shifts in relative incomes influence wage setting in the formal sectors of the economy. Relative wages have a strong normative element, and wage pressures develop in the formal sectors as workers in these sectors try to preserve 'fair relative wages. Wage inflation in the formal sectors does not, however, restore the previous relative wages: nominal wage gains in the formal sectors raise incomes in the informal sector *pari passu*, maintaining the relative incomes that were at odds with prevailing social norms. Thus, in the absence of policy intervention inflationary expectations may build up and lead to explosive inflation. Monetary tightening can keep inflation at the target rate, but the exchange rate appreciates and economic activities shift towards the nontradable sectors; that is, under the standard mainstream policy recommendation, large shocks to domestic demand can cause deindustrialization.

Wage norms and informal indexation are central to this process, but social norms evolve endogenously, and this path dependency allows structural transformation and economic development. The gradual elimination of wage premia in the formal sector and underemployment in the informal sector need not provoke high inflation. Large shocks to relative incomes, by contrast, can be inflationary, and if our argument is correct, the standard prescriptions for macroeconomic policy are misguided.

The period from the early 1980s to the turn of the century saw the gradual establishment of a hegemonic macroeconomic agenda of balanced government budgets, inflation targeting and liberalized goods and capital markets. Even when not part of an official set of guidelines and objectives², these principles have guided policy in many countries over the last 20-40 years, developed as well as developing.

Inflation targeting is often described as successful, despite challenges of implementation in emerging and developing economies.³ Even when combined with balanced budgets, however, inflation targeting has often failed to deliver the anticipated improvements in real economic performance. This is no accident, we argue. A combination of balanced budgets and inflation targeting can amplify fluctuations and lead to slow economic growth and premature deindustrialization.⁴

The commodities boom of the early 2000s exemplifies the dangers of the policy mix. Rising commodities prices relaxed both government budget and balance of payments constraints for many middle-income countries and allowed an expansion of aggregate demand. Incipient inflationary pressures were addressed using monetary policy, and the resulting appreciation of the exchange rate carried additional short-term political benefits by increasing peoples real purchasing power. The negative effects of the policy showed up later. An overvalued exchange rate contributed to deindustrialization and a large expansion of the nontradable sector. When the boom came to end, exchange

¹We use the term 'dual economies' to denote economies with pronounced differences between modern sectors and low-productivity informal sectors with significant amounts of underemployment.

²In the European Union the prescriptions are enshrined in the Stability and Growth Pact for fiscal policy and the explicit specification of the primary objective of the ECB as maintaining price stability

³Fraga et al. (2003)

⁴Rodrik (2016) applies the concept of premature industrialization to countries whose manufacturing sector has declined at income levels much lower than those at which developed countries began to deindustrialize.

rates depreciated, inflation increased, and the economies went into recession with a less developed productive structure. The macroeconomic policy prescriptions had contributed to and exacerbated a classical Dutch disease.

The Brazilian case, which is described in greater detail in section 3, illustrates our argument. The country is not unique, however, and the analytical framework in this paper has, we believe, wider applicability. The economic trajectory of most Latin American countries since the turn of the century has important similarities with the Brazilian experience. According to the IMF (2018), the commodities boom boosted the economy of the majority of countries in the region both directly and indirectly via increased fiscal capacity (converted into higher public sector employment, cash transfers and public investment).⁵ The expansion was particularly strong in the natural resource and nontradable sectors, notably construction, and the manufacturing sector in the region shrank from 16.4% in 2003 to 13.3% in 2012.⁶ Many developing economies outside Latin America also have a historical dependence on primary commodities exports⁷; Ghana, for instance, followed policies of sound finance and inflation targeting and experienced a similar process of deindustrialization.

We do not suggest that the problems associated with overvalued exchange rates have gone unrecognized. Many economists have warned of its dangers, and the recognition is not confined to academics.⁸ The Washington consensus (Williamson (1990)) included competitive exchange rates as one of its 10 policy prescriptions. In a later discussion, however, Williamson (2004) suggested that already by 1990, the consensus had shifted away from seeing competitive exchange rates as a priority. IMF studies, including Savastano, Masson, and Sharma (1997), have also pointed to potential conflicts in developing countries between inflation targeting and a concern for external competitiveness. But despite these warnings and notes of caution, inflation targeting has been increasingly adopted, also by developing economies, and exchange rate concerns have been largely ignored.

The fiscal dimension of the standard policy recommendations has come in for criticism too. Our analysis is in line with some of these criticisms. Austerity policies – often motivated by the alleged dangers of public debt – can do and have done immense damage; European policies after the 2008 financial crisis is a case in point, and fiscal consolidation efforts in Brazil hurt the economy when the commodities boom came to an end and the economy was moving into recession. A focus on balanced budgets effectively promotes a procyclical policy and exacerbates macroeconomic instability with detrimental effects on long-term growth.

But stabilization is different from sustained fiscal stimulus. Some developed economies have faced severe structural aggregate demand problems (Japan is a clear example), and a balanced budgets and inflation targeting policy impart a long term deflationary bias without full employment in those economies. Developing economies, however, do not have structural aggregate demand problems, and expansionary aggregate demand policy is not a general instrument of development.⁹ The problem with the standard prescriptions when applied to developing economies is not a deflationary bias, but that it prevent structural development. Abandoning balanced budgets in favor of more aggressive sustained fiscal expansion while sticking with rigid monetary policies can aggravate the damage and push these developing economies further in the direction of deindustrialization.

To summarize, in this paper we present a model of inflation in dual economies. Sectoral specificities and interactions between demand and supply side forces are at the core of the model. If the inflation analysis is correct, second, we show that a policy combination of balanced budgets and inflation targeting may derail economic development.

⁵These developments were pronounced in Ecuador, Bolivia, Argentina, Peru, Brazil, Colombia and Paraguay.

⁶World Bank data. <https://data.worldbank.org/indicator/NV.IND.MANF.ZS?locations=ZJ>

⁷According to the United Nations Conference on Trade and Development (UNCTAD (2019); UNCTAD (2017)), 102 countries were in this condition in the period 2013-2017, mainly in Africa, Middle East, and East Asia.

⁸E.g. Krugman (1987), Skott and Ros (1997), Rodrik (2008), Razmi, Rapetti, and Skott (2012) and Bresser-Pereira, Oreiro, and Marconi (2014).

⁹Nakatani and Skott (2007) analyze the Japanese structural aggregate demand problem. Skott (2016) discuss fiscal policy and functional finance in mature and dual economies.

Formal models help structure and clarify ideas and inform empirical studies. To be useful they must simplify, and the model in this paper is no exception. Our modeling approach, however, may be unfashionable: the absence of intertemporally optimizing representative agents may seem like a glaring deficiency for some. We make no apologies for this. In our judgment the simplifications we have chosen provide a much better starting point for the analysis of developing economies than DSGE models with intertemporal optimization, rational expectations and fluctuations around a steady growth path with a natural rate of unemployment.

The rest of the paper is structured in four sections. Section 2 uses a four-sector model of a dual economy model with conflict-driven inflation to examine some implications of balanced budgets and inflation targeting. The Brazilian case is outlined in Section 3 which also includes a discussion of differences and similarities between our account and other inflation theories and interpretations of the Brazilian experience. Section 4 offers a few concluding comments and observations.

2 The model

2.1 Overview

The model includes four sectors: a commodities sector producing a pure export good, two formal sectors, one producing a tradable and one producing a nontradable good, and an informal sector producing a nontradable good.

We use the term informal as a short-hand for activities with substantial underemployment, low productivity and low incomes. Most of these activities are informal in a legal sense, but it is not the legal status, ‘formality *per se*, that is important; the registration of street vendors would not change the reality of their situation. La Porta and Shleifer (2014) find that the informal sector is large in low income countries and has much lower productivity and average incomes than formal sectors. Workers are “rather similar in informal and formal firms” (p. 125), “many informal entrepreneurs would gladly close their businesses to work as employees in the formal sector, if offered the chance” (p. 112), and “regulation is not what keeps informal firms down” (p. 116). The evidence, they conclude, “is broadly consistent with the dual view of informality” associated with Lewis and the classical development theory.

The informal sector in middle income countries typically includes a myriad of precarious urban activities, many of them in services. The output of the sector is nontradable, but a sizable part of nontradables, particularly in services and commerce, is produced by a formal sector. The nontradable formal sector, moreover, has been seen as central to the inflationary dynamics in middle income countries. The distinction between formal and informal nontradable sectors therefore can be important.

2.2 Assumptions

2.2.1 Production and pricing

The **formal sector** is composed of two subsectors, a **tradable** and a **nontradable** one. Both sectors use capital and labor. Capital stocks are given in the short run and labor is the only variable input

$$\begin{aligned} M &= F^M(L_M) \\ S &= F^S(L_S) \end{aligned}$$

M and S denote the output of tradable and nontradable goods; L is employment with subscripts denoting the sector.

Nominal wages are predetermined in both formal sectors, and the marginal product of labor and the markup are taken as constant in the benchmark version of the model. Thus, prices become predetermined too, and changes in demand are met by quantity adjustments. Normalizing labor productivities to one, we have

$$M = q_M L_M = L_M \quad (1)$$

$$S = q_S L_S = L_S \quad (2)$$

$$p_M = \frac{w_M}{(1 - \pi_M)q_M} = \frac{w_M}{1 - \pi_M} \quad (3)$$

$$p_S = \frac{w_S}{(1 - \pi_S)q_S} = \frac{w_S}{1 - \pi_S} \quad (4)$$

where π_i denotes the profit share in sector i .

The **resource sector** produces a pure export good, which we shall refer to as ‘commodities; the output of this sector may include oil, minerals or specific agricultural goods. For simplicity it is assumed that no domestic inputs are involved in its production. This assumption is clearly extreme, but the qualitative analysis is unaffected as long as export shocks have little effect on the allocation of domestic inputs of labor and capital in this sector. In other words, we are capturing the exogenous rents that characterize these activities. The value of exports in foreign currency (Z) is exogenous.

The **informal sector**, finally, produces a non-tradable good and uses labor as the only input. Workers that fail to find jobs in the formal sectors move to the informal sector which is characterized by hidden unemployment and underemployment. Thus, if N denotes the total labor force, we have

$$L_A = N - L_S - L_M = (N - S - M) \quad (5)$$

The average income in the informal sector is given by

$$w_A = \frac{p_A A}{L_A} \quad (6)$$

where A is output in the informal sector and p_A its price level.

2.2.2 Demand

The two nontradable sectors produce pure consumption goods. The domestically produced tradable good, by contrast, can be used for either investment or consumption. It is assumed that all investment goods are produced domestically.¹⁰ Investment is determined by the levels of output in the two sectors (corresponding to the utilization rates of capital) and the real rate of interest (r),

$$I = I(M, S, r) \quad (7)$$

All wages and informal-sector incomes are spent on consumption while only a portion $(1 - s)$ of profits is consumed. The revenues from commodities go partly to the government and partly to the private sector. We assume that a portion ϵ of the revenues is spent on public and private consumption and that the state receives a fixed proportion of the revenues.

¹⁰The results do not change qualitatively if this assumption is relaxed.

Algebraically, nominal private consumption (C) and government consumption (G) are given by:

$$C = p_A A + (1 - \pi_S) p_S S + \pi_S p_S S (1 - s) + (1 - \pi_M) p_M M + \pi_M p_M M (1 - s) + (1 - \beta) \epsilon E Z \quad (8)$$

$$G = \beta \epsilon E Z \quad (9)$$

where E is the nominal exchange rate and β the share of resource revenues going to the state. For simplicity, we leave out taxation of incomes in the non-resource sectors and assume that government spending is determined by taxes and royalties from the resource sector; a balanced government budget is obtained when $\epsilon = 1$ and a fiscal surplus if $\epsilon < 1$. Given the purposes of this paper, little would be gained by including taxes on wages and profits in the formal sectors.

Private and government consumption are split between four goods: two nontradables (formal and informal) and two tradables (domestically produced and imported). The benchmark version of the model assumes that each of the four goods receives a fixed share of total domestic spending on consumption (corresponding to a Cobb-Douglas utility function); the shares of the M , S and A sectors are α_M , α_S , α_A , leaving $\theta = (1 - \alpha_M - \alpha_S - \alpha_A)$ as the share for imports.

Net exports are equal to the sum of resource exports and net exports of modern sector goods. Exports of the tradable M -good (X) are determined by foreign income and the international competitiveness of the domestic tradable sector; imports are determined by a share (θ) of domestic consumption. The main determinant of competitiveness in the short run is the relative price $p_M^* E / p_M$, and – normalizing the foreign currency price of imported goods to one ($p_M^* = 1$) and omitting foreign income as an explicit argument – we assume that

$$NX = p_M X(\eta) - \theta(C + G) + p_M \eta Z; \quad X' > 0 \quad (10)$$

where

$$\eta = \frac{E p_M^*}{p_M} \quad (11)$$

With a slight abuse of terminology, we shall refer to η as the real exchange rate.

2.3 Short run equilibrium

We have the following equilibrium conditions for the M , S and A sectors:¹¹

$$p_M M = \alpha_M (C + G) + p_M I + p_M X \quad (12)$$

$$p_S S = \alpha_S (C + G) \quad (13)$$

$$p_A A = \alpha_A (C + G) \quad (14)$$

Using (8)-(9) and (13)-(14) aggregate domestic consumption – private and government – can be written

$$C + G = \frac{p_M [(1 - \pi_M s)(I + X) + \eta Z \epsilon]}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} \quad (15)$$

From equations (12)-(13) and (15) it follows that

$$M = \alpha_M \frac{(1 - \pi_M s)[I(M, S, r) + X(\eta)] + \eta Z \epsilon}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} + I(M, S, r) + X(\eta) \quad (16)$$

$$S = \alpha_S \frac{p_M (1 - \pi_M s)[I(M, S, r) + X(\eta)] + \eta Z \epsilon}{p_S (\theta + s(\alpha_M \pi_M + \alpha_S \pi_S))} \quad (17)$$

¹¹The investment and export variables (I and X) are in real terms. With multiple consumption goods, however, private and public consumption are defined in nominal terms.

The short-run Keynesian solution defined by equations (16)-(17) is economically meaningful if the Keynesian stability conditions are satisfied. The standard intuition still applies for this two-sector system: Keynesian stability requires investment to be relatively insensitive to variations in output, now taking into account the interactions between the two sectors.

As shown in Appendix A, if M^* and S^* denote the short-run equilibrium solutions, we have

$$\begin{aligned} \frac{\partial M^*}{\partial Z} &> 0; & \frac{\partial S^*}{\partial Z} &> 0 \\ \frac{\partial M^*}{\partial \eta} &> 0; & \frac{\partial S^*}{\partial \eta} &> 0 \\ \frac{\partial M^*}{\partial r} &< 0; & \frac{\partial S^*}{\partial r} &< 0 \end{aligned}$$

Intuitively, an increase in commodity revenues stimulates consumption and raises capacity utilization of both sectors. The benchmark specification of demand ensures that the Marshall-Lerner conditions hold, and a depreciation (a rise in η) would boost demand in the tradable sector with positive derived effects for nontradables. Analogously, an increase in interest rates would have its direct effect (in this case negative) on investment and the demand for tradables with derived effects for nontradables.

Aggregate income in the informal sector can be determined by (14)-(15) or alternatively, using (13)-(14), by noting that

$$p_A A = \frac{\alpha_A}{\alpha_S} p_S S \quad (18)$$

The effects of a commodity boom on net exports are ambiguous without restrictions on the various parameters. A shock to commodity revenues has a direct impact on domestic consumption with derived effects on investment, domestic saving and imports. The effect on net exports can become negative if the consumption rate out of the commodities revenue is high (ϵ is large), the import propensity out of consumption is large (θ is large) or the sensitivity of accumulation to changes in output is sufficiently high (see Appendix A). The derived effects on imports may also dominate the positive effects of a depreciation on total exports (on $X(\eta) + \eta Z$), and the trade balance effects of a depreciation are ambiguous.

2.4 Wage setting and inflation

The levels of money wages in the formal sectors are predetermined in the short run. But the average income in the informal sector is endogenous, and the rates of wage inflation in the formal sectors cannot be taken as constant. Combining equations (5)- (6) and (17)-(18) we get

$$w_A = \frac{\alpha_A}{N - M - S} \frac{p_M [(1 - \pi_M s)(I + X) + \eta Z \epsilon]}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} \quad (19)$$

Changes in the average level of incomes in the informal sector need not affect the prices of informal commodities: a rise in demand for informal goods can raise the price p_A , or it can reduce the rate of underemployment and raise the level of output A ; of course, it can also be some combination of the two. But even if prices of informal goods stay constant, an increase in informal-sector incomes has repercussions for wage inflation in the formal sectors if workers in these sectors react by pushing to increase their income.

The notion that norms of fairness influence wage setting has a long history in economics. Keynes (1936) famously explained wage stickiness by workers resistance to wage cuts that could reduce their relative wages, and Akerlof and Yellen (1990) pointed to wage norms as the source of unemployment among low-wage workers. Experimental and real-world evidence supports these general ideas (e.g. Kahneman et al. 1986, Bewley (1998)).

Our benchmark specification of wage inflation in the formal sector embodies relative-wage norms: increases in informal-sector incomes generate cost-push pressures on wages in the formal sector. Formally, we assume that

$$\hat{w}_M = \phi_M\left(\frac{w_M^f}{w_M}\right) + \hat{p}^e; \quad \phi_M(1) = 0, \phi'_M > 0 \quad (20)$$

$$\hat{w}_S = \phi_S\left(\frac{w_S^f}{w_S}\right) + \hat{p}^e; \quad \phi_S(1) = 0, \phi'_S > 0 \quad (21)$$

where \hat{p}^e is the expected inflation rate. The ‘fair wages’ w_M^f and w_S^f are determined by the average incomes and wages in other sectors, that is

$$w_M^f = f^M(w_A, w_S) \quad (22)$$

$$w_S^f = f^S(w_A, w_M) \quad (23)$$

The f -functions are taken to be linearly homogenous with positive partial derivatives. The specification implies that for given values of the predetermined wages w_M and w_S , wage inflation is a strictly increasing functions of w_A . Setting $w_i^f = w_i$, equations (22)-(23) can be solved for the relative wages $(\frac{w_M}{w_A}, \frac{w_S}{w_A})$ that will give $\hat{w}_M = \hat{w}_S = \hat{p}^e$. Let this ‘fair-wage solution be

$$\frac{w_M}{w_A} = \mu_M \quad (24)$$

$$\frac{w_S}{w_A} = \mu_S \quad (25)$$

Wages in the formal sectors exceed average incomes in the informal sector, making it attractive for workers to move to the formal activities, that is $\mu_M > 1, \mu_S > 1$. This corresponds to the classical assumption of elastic labor market in dual economies proposed in Lewis (1954). Firms pay a wage premium also because it increases productivity. Adverse effects of unfair wages may derive from collective action, including strikes, or unfair treatment may hurt ‘morale and reduce the ‘effort of individual workers, as in Akerlof and Yellen (1990) and other efficiency wage models.

2.5 Inflation targeting with constant fairness norms

A positive shock to w_A , thus, generates inflationary pressures on formal sectors; there are, however, asymmetries between them. The absence of foreign competition in the nontradable sector is likely to make firms less reluctant to grant wage increases, and we would expect to see faster adjustment speeds in the nontradable formal sector than in the tradable one. In the limiting case in which wage inflation in the tradable sector is completely insensitive to changes in relative wages ($\phi'_M = 0$), the increase in the prices of nontradable goods will not ignite a process of continuing inflation. Nominal spending on private and public consumption is independent of the price level in the nontradable sectors (equation (15)); and an increase in the prices of nontradable goods has no effect on average informal-sector incomes.

Apart from this extreme case, however, a positive shock to w_A generates a rise in w_M which will be translated to p_M , and the increase in the prices of tradable goods, on its turn, raises the nominal demand for non-tradable goods (equation (15)): that is, an increase in w_M produces a proportional rise in the average nominal income in the informal sector and leaves the ‘relative wage w_M/w_A unchanged if r and η are kept constant. The increase in p_M will also affect sector S , generating some combination of increases in w_S (given the increase in w_M) and L_S (given the increase in nominal demand caused by the rise in p_M). Whatever the effects on w_S , the interactions between an initial rise in w_A and the ensuing cost-push adjustments in tradable-sector wages and prices – which feed

into new increases in nominal demand for the informal good – can produce a cycle of persistent and, conditioned on how expectations are formed, potentially explosive inflation.

Intuitively, the asymmetry between tradable and nontradable prices is related to a standard Keynesian multiplier process. Incomes in the tradable, nontradable and resource sectors all generate consumption demand. A constant fraction of consumption demand goes to the nontradable sector, and this feedback creates a multiplier relation: incomes in the nontradable sector are determined by the product of the multiplier and the ‘outside demand from the tradable and resource sectors.

Central banks cannot control inflation perfectly and instantaneously, even at the best of times. But because of the interactions between wages in the tradable sector and incomes in the informal sector it becomes imperative to stamp out price acceleration in the tradable sector; conversely, there will be no explosive inflationary cycle, and inflation targeting can be successful as long as central banks keep wage inflation in the tradable sector at the target rate.

Using equation (20) and assuming that the central bank has succeeded in establishing the credibility of the inflation target ($\hat{p}^e = \hat{p}^T$), this condition for $\hat{w}_M = \hat{p}^T$ can be written

$$\phi_M(f^M(\frac{w_A}{w_M}, \frac{w_S}{w_M})) = 0 \quad (26)$$

Depending on initial conditions, wage inflation in the nontradable sector may exceed or fall short of \hat{p}^T . If this happens and (26) holds, the relative wage w_S/w_M will approach $w_S^f/w_M = f^S(w_A/w_M, 1)$. Plugging this value of w_S/w_M into (26), we have

$$\phi_M(f^M(\frac{w_A}{w_M}, f^S(w_A/w_M, 1))) = 0 \quad (27)$$

Equation (27) defines the wage ratio w_M/w_A that is compatible with fair wages in both sectors, $\hat{w}_M = \hat{w}_S = \hat{p}^e$. Thus, equation (27) is equivalent to (24). Combining equations (3), (19) and (24), we now have

$$\frac{1}{\mu_M} = \frac{\alpha_A}{N - M - S} \frac{\frac{1-\pi_M s}{1-\pi_M}(I + X) + \frac{\eta Z \epsilon}{1-\pi_M}}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} \quad (28)$$

If wage norms are constant, successful inflation targeting requires that, on average, equation (28) must be satisfied in the medium run, at least approximately. Ignoring short-run deviations, consider the implications of a ‘perfect policy regime’ under which equation (28) holds at all times. Monetary policy influences the relative wage and the inflation rate via the demand for the tradable sector, both because of the direct influence of interest rates on investment (equation (7)) and because of the appreciation caused by a rise in the domestic interest rate (equations (10) and (12)).

Standard interest parity conditions suggests the determination of the nominal exchange rate E by domestic interest rates, foreign interest rates, the expected future exchange rate, and risk considerations. The expected exchange rate E^e and the country risk τ may change in response to resource booms and other exogenous shocks, whether domestic or international. Subsuming these factors and the exogenous or predetermined values of i^* , p_M^*/p_M , \hat{p}^e in the shift variable ρ , we assume that the real exchange rate is given by

$$\eta = \frac{p_M^* E}{p_M} = \eta(r; \rho); \quad \eta_r < 0 \quad (29)$$

2.6 Commodities booms, inflation targeting and the Dutch disease

Inflation targeting endogenizes the interest rate, and equations (28)-(29) in combination with (16)-(17) determine the levels of output in the formal sectors, the real interest rate r and the real exchange rate η . The comparative statics become quite different from those in section 2.3.

Policy makers still follow principles of sound finance and maintain a non-negative government

balance. But a commodities boom feeds consumption demand, and contractionary monetary policy is needed to keep inflation at the target level. In this policy regime, a commodities boom produces a contraction in the tradable sector while nontradables expand. Formally, we have (see Appendix B for details)

$$\frac{\partial M}{\partial Z} < 0; \quad \frac{\partial S}{\partial Z} > 0$$

Intuitively, interest rates have to be raised in order to avoid a violation of the prevailing relative-wage norms and the ensuing inflation. The direct effects of higher interest rates fall on the tradable sector: investment falls and the currency appreciates which reduces exports.¹²

The shifts in the composition of formal-sector output away from tradable goods have dynamic effects on the patterns of investment which also shift towards the nontradable sector. The long-term effects of these shifts are beyond the scope of this paper.

2.7 Money illusion, endogenous norms and path dependency

If the fairness norms were fixed and time-invariant, the analysis in section 2.6 would represent a twist on a common story: high wage demands by ‘insiders (in this case workers in the formal sector) can lead to high natural rates of unemployment.

But social norms are sustained by continuous validation; they change gradually when outcomes differ from expectations. Like the role of fairness in wage setting, the conventional aspect of norms has a long history, and evidence from social psychology and behavioral economics support the path dependency of social norms. In the words of Kahneman, Knetsch, and Thaler (1986) (p. 730-1),¹³

the reference transaction provides a basis for fairness judgments because it is normal, not because it is just. Psychological studies of adaptation suggest that any stable state of affairs tends to become accepted eventually, at least in the sense that alternatives to it no longer readily come to mind. Terms of exchange that are initially seen as unfair may in time acquire the status of reference transaction. Thus, the gap between the behaviour that people consider fair and the behavior that they expect in the market-place tends to be rather small.

Following Kahneman and the behavioral evidence, the fair wage ratio μ_M changes over time in response to differences between actual and fair relative wages, that is, in response to differences between w_M/w_A and μ_M . Formally, let

$$\hat{\mu}_M = \lambda \left(\frac{\omega}{\mu_M} - 1 \right) \tag{30}$$

where $\omega = w_M/w_A$. Now consider a trajectory in which the relative wage is kept slightly below the fair relative wage (but above one so that the tradable sector can still attract workers). Formally, let $\omega = (1 - a)\mu_M > 1$ where $a > 0$ is small. Using equation (30),

$$\hat{\mu}_M = -\lambda a < 0$$

The fair wage premium in the tradable sector falls gradually, and the actual premium falls with it ($\omega = (1 - a)\mu_M$).

Equations (20)-(21) imply that discrepancies between fair and actual wages produce wage inflation above the expected rate (which by assumption equals the target rate if the later is considered

¹²The commodities boom may reduce country risk and generate an appreciation of the exchange rate. If the appreciation causes a large reduction in the demand for tradable goods, the interest rate could fall, even though the risk-adjusted rate has increased.

¹³Economists had made similar observations before ‘behavioral economics; see Hicks (1975).

credible), and it might seem that expectations cannot remain anchored to the target. Small deviations from fairness will be associated with small deviations of actual from expected inflation, but natural-rate theory does not permit persistent deviations of this kind, even if small. Expected inflation would increase and inflation would be explosive. Here again, however, the behavioral evidence challenges the standard story.

Norms of fairness attach to both nominal and real magnitudes. There is strong evidence, for instance, that a fall in nominal wages is seen as unfair and that the level of nominal wages exhibits downward stickiness (Akerlof, Dickens, et al. (1996), Shafir, Diamond, and Tversky (1997)). In more general terms, the fairness of prices or wages is assessed in relation to past nominal values as well as in relation to the current values of other prices and wages, and the weights of these different evaluations are context dependent. Inflation becomes less salient if inflation rates are low and, by the same token, deviations from established inflation anchors become less salient if the deviations are small.¹⁴ Important aspects of this argument and its implications for wage inflation were anticipated by Rowthorn (1977). The nominal evaluation and the inattention to price inflation becomes dominant when inflation is low; when inflation is high, by contrast, it becomes costly to ignore price changes and expected price inflation becomes an important determinant of wage inflation. As a simple formalization, Rowthorn suggested that inflation will not be taken into account in wage bargaining as long as it stays below some threshold level.

In the present context, these behavioral arguments suggest that as long as the deviation of the actual from target inflation is kept small, expectations can remain anchored at the target level. In short, relative wage norms may be important in developing economies, but the norms are path dependent and minor deviations of actual from expected inflation may go unnoticed or, if noticed, may have no impact on expected future inflation. Developing economies do not suffer from a high ‘natural rate of underemployment’ whose only remedy is ‘labor market reforms’. Sustained non-inflationary transformation with a gradual elimination of underemployment in the informal sectors and a gradual closing of sectoral wage gaps is perfectly possible.

The potential for explosive inflation following a large shock to relative incomes is also clear. A large shock to relative incomes leads to large increases in wage pressures and large discrepancies between actual and target inflation. The ‘inattention threshold may be breached, and the scene is set for an accelerationist dynamics. The feedback effects from nominal incomes in the formal sectors to average incomes of informal workers prevents wage inflation in the tradable sector from restoring ‘fair relative wages and although fairness norms will be changing, the speed of norms adjustment is likely to be much lower than that for inflation expectations.

Due to space limitations, formal presentation of extensions and robustness test will be suppressed in this version of the paper. Please see full article for those (Martins and Skott, forthcoming). The results of the baseline specification are robust to endogenous markups and labor productivity, and also if investment goods are imported and/or nontradable. If fair wages are codetermined by consumption real wages and nominal wages, it will be less likely a explosive inflationary dynamics.

3 A brief summary of the recent Brazilian experience

3.1 Stylized facts

After the re-democratization process initiated in the 1980s and the end of the hyperinflation in the 1990s, Brazil entered the 21st century with hopes of a more stable development path. The dominant view was that by opening the economy and reducing state interference, the country would enter a

¹⁴Inattention may be ‘rational; Sims (2003). The substance of this argument – inattention is both sensible and behaviorally plausible – is surely right, even if the ‘rational inattention literature focuses too much on the strict ‘rationality of the inattention.

sustainable catch up route. In terms of macroeconomic policy, the strategy was expressed in a ‘tripod rule: floating exchange rates, primary fiscal surplus, and inflation targeting.

The commodities boom added a new element. The Brazilian terms of trade began to improve from 2002, peaking in 2011 and falling again to a local minimum in 2015. The net exports of commodities¹⁵ went from US\$ 12,9 billion in 2002 to US\$ 99 billion in 2011; commodities represented 40% of total exports in 2002, rising to more than 60% in 2011¹⁶. Surging commodity exports opened up space in the balance of payments to increase imports; in the same period, machines and transport equipment deficit went from US\$ 4.1 billion to US\$ 48 billion, and manufactured goods surplus decreased from US\$ 6.9 billion to US\$ 3 billion. The large increase in imports of non-commodities reflected a boost to domestic aggregate demand and an appreciation of the exchange rate.

Two main channels link the increase in revenue from exports to domestic absorption: the increase in private consumption due to the higher income in the sectors directly associated with the exports of commodities, and the increase in government expenditure following the windfall revenue from taxes and royalties. These initial movements were then amplified by multiplier effects on consumption and investment.

The period from 2003 to 2011 saw an acceleration of GDP growth, with an average of 3.5% from 2002 to 2014 – and 4.5% between 2007 and 2011 – compared to 2.6% in the previous decade (1992-2001). Private consumption was the fastest-growing component of demand during the boom, both in relative and absolute terms, going from 61.7% of the GDP in 2002 to 64.7% in 2011 and reaching 67.4% in 2015¹⁷. Federal government expenditure also accelerated, reaching an annual average real growth rate of 8% during the ascendant phase of the boom (2003-2010), compared to 5.8% from 1998 to 2002 and 3.6% between 2011 and 2015¹⁸. Public investment also increased between 2005 and 2010, but in absolute terms the expenditures were largely concentrated in consumption¹⁹.

The fiscal expansion, however, did not violate a balanced budget prescription; the federal government maintained continuous fiscal surpluses – on average 2.2% of GDP from 2002 to 2011 – and the debt to GDP ratio fell substantially. There is robust evidence that local governments also used the increase in revenues directly and indirectly related to the commodities boom to increase expenditure while keeping balanced budgets. The average fiscal surplus of the public sector, which includes federal and local governments, was 3.1% of GDP from 2002 to 2011, and the net public indebtedness fell from 55.8% of GDP in 2002 to 36.4% in 2011.²⁰ The windfall boosted private and government consumption, while keeping the public budget balanced.

The growth rates, however, were uneven across sectors. In the years before the intensification of the commodities boom, from 2000 to 2004²¹, the manufacturing sector grew at an annual average rate of 4%, significantly above those of retail (2.6%) and services (2.2%)²². The ranking was reversed during the ascendant part of the boom years, from 2005 to 2011, when the rate of growth of manu-

¹⁵Mineral fuels, lubricants and related materials; Food products and live animals; and Non-edible raw materials (except fuel).

¹⁶*Estatísticas de Comércio Exterior* (n.d.)

¹⁷From 2002 to 2010, private investments grew more rapidly, from 18.2% to 21.8% of GDP, but lost ground from 2011, reaching 19.3% in 2015. Brazilian National Accounts, IBGE.

¹⁸Using data from Ministry of Economy, Industry, Foreign Trade and Services of Brazil.

¹⁹Federal public investments went from 0.45% of GDP in 2002 to 0.79% in 2010. Total expenditure of the federal government in the same period went from 15.9% of the GDP to 18.2%. Ministry of Economy, Industry, Foreign Trade and Services of Brazil and Observat rio de Pol tica Fiscal - IBRE/FGV.

²⁰Data from *Banco Central do Brasil*. Orais and Gobetti (2017) provide slightly different numbers; they suggest a reduction in public debt from 60% of GDP in 2002 to 31% in 2013.

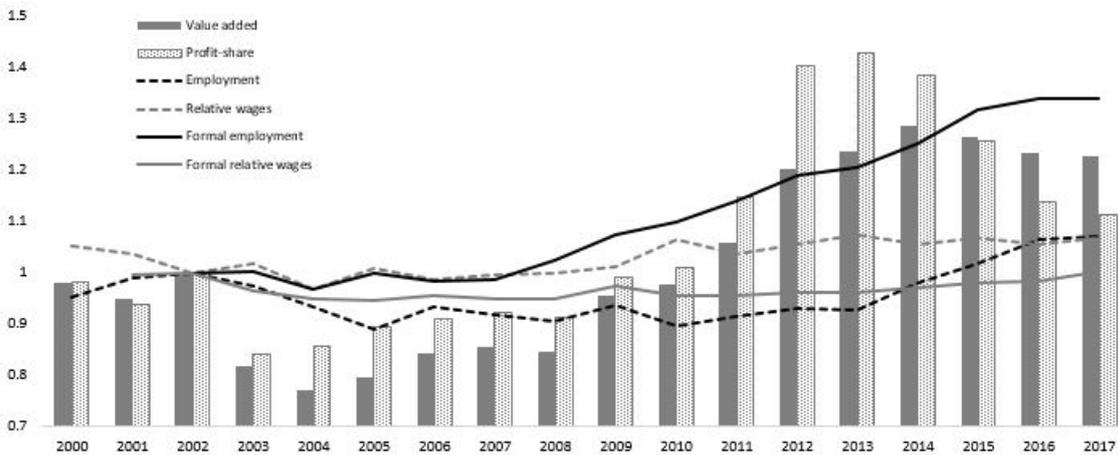
²¹Manufacturing benefitted from the depreciation of the exchange rate level in 2002. The increase in manufacturing employment, for instance, is concentrated in 2004 and 2005, and the most positive net exports result since 1997 was achieved in 2006, with a surplus of US\$ 14.5 billions. Thus, looking at sectoral data, it is important to bear in mind that effects from previous shocks still operate during the initial years of the commodities boom.

²²Identified as other services in the Brazilian national account system, which comprises all usual private services such as education, health, lodging and food services, domestic services, among others.

facturing sector was 2.3%, and those of retail and services increased to 4.7% and 4%. From 2011 to 2015 the gap is even wider, with manufacturing *decreasing* annually 3.1% while retail and services changed, on average, -0.2% and 0.8%.

Trade contributed to the uneven sectoral development. Manufacturing faces international competition, and with an appreciating real exchange rate an increasing share of the demand for manufacturing goods was supplied by imports. According to Bielschowsky, Squeff, and Vasconcelos (2015), during 2005-2008, more than 22% of the increase in domestic consumption of manufactures was supplied by net exports, comparing to only 6.1% in the period 2003-2005. Services, by contrast, are largely nontradable, and nontradables performed better in this period, particularly in terms of share of GDP and profitability. Investment shows a similar pattern: according to Miguez (2016), before the intensification of the commodities boom (2001-2004), the average annual growth rate of investment in real terms was -4.2% for the manufacturing sector and -7.5% combining retail and other services activities, while during the boom period (2005-2011), these rates went up, respectively, to 6.6% and 14.6%.

Figure 1: Ratio of Non-tradable to Tradable sectors - VA, profit-share, employment, wages (2002=1)



Source: Authors calculation based on IBGE and RAIS/Ministry of Work and Employment of Brazil. Non-tradables consist of the private services sector, retail and construction. In line with the model definition, tradables are non-commodity tradables, or the manufacturing sector.

Faster economic growth was reflected in the labor market, with measured unemployment decreasing from around 12% in 2002 to less than 5% in 2014, and formalization going from 52% to more than 63% in the same period²³ (Komatsu and Menezes Filho (2015)). Here again the figures differ across sectors. In general (formal and informal), relative employment in non-tradable and (non-commodity) tradable sectors stayed constant, while this ratio increased significantly in the case of formal employment (figure 1). In terms of the model presented in section 2, this means a shift from L_A to L_S with $\frac{L_M}{L_A+L_S}$ stable. This dynamics, combined with the greater increase in value added of non-tradable sectors (formal and informal), displayed in figure 1, suggests a reduction in the level of underemployment in the non-tradable, informal sector.

However, despite the superior dynamics in non-tradable, sectoral relative wages shifted only slightly against manufacturing workers; this is true for both formal and general (formal and informal) wages, although stronger for the latter. Thus, manufacturing workers were able to increase their nominal wages following increases in the other, non-tradable sectors; in terms of the model, this implies that $\frac{w_M}{w_S}$ stayed roughly constant while $\frac{w_M}{w_A}$ slightly decreased. This rise in nominal

²³Data for metropolitan areas.

manufacturing wages was reflected partially in prices and partially in the reduction of profits. These changes were contemporaneous to an increase in conflicts in the labor market; the number of strikes went from 302 (23.138 hours) in 2004 to 2.050 (111.342 hours) in 2013 (DIEESE (2005), DIEESE (2014)).

The commodities boom and the associated increase in private and government consumption also produced inflationary pressures. Capital flight and a steep depreciation on the eve of the presidential election of Luiz Inacio Lula da Silva from the Workers Party (PT) had produced a spike in inflation in 2002, but inflation was kept consistently within the target range from 2004 to 2015. Price movements displayed sectoral heterogeneity, however. Inflation in the service sector remained consistently above average inflation, exceeding the target range since 2008. High inflation in services was offset by the lower inflation for (non-commodity) tradable goods and for the output of state-owned companies, including oil (Petrobras) and electricity (Eletrobras).

The downward pressure on tradable goods prices was a result, to a large extent, of monetary policy. The basic interest rate (SELIC) followed a downward trend from 2002 to 2008, but the premium over international rates (the LIBOR is used here) was kept high despite a significant reduction in country risk²⁴ - from 2008 to 2015, the relative interest rate actually increased while the measures of the country-risk stayed constant. A high interest premium encouraged the inflow of international capital, reinforcing pressures from the commodity boom towards exchange rate appreciation in both nominal and real terms. The policy was intensified as inflation pressures increased, particularly between 2010 and 2012, with a step increase in the interest rate differential despite a stable country-risk.

From the 2011 to 2014, macroeconomic policy became erratic. After months of tighter fiscal and monetary policies, contractions were abandoned in mid-2011 with the worsening of international economy (European debt crisis and end of commodities boom). Aiming at increasing private investments, fiscal policy was relaxed, but now focused on tax exemptions and social transfers with a parallel reduction in public investments. Monetary policy also became loosened, the basic interest rate was lowered, reversing some of the previous exchange rate appreciation, and interest spread of public banks were reduced. With a depreciating exchange rate, state-controlled prices took on a greater role in controlling inflation. Unsuccessful in increasing investment and under political pressure, this new policy mix was short-lived, though, being partially reversed in 2013, with resumption of monetary tightening, and completely in 2015, in direction of fiscal austerity and reduced state intervention. Without the short-term counterbalancing effect from state-controlled prices and the exchange rate depreciating due to the end of the commodities boom, inflation spiked in 2015, returning to its target only in 2017 in the wake of the severe crisis that had reduced real GDP by 6.7% in those two years.

3.2 Our interpretation

The stylized facts of the recent Brazilian trajectory are consistent with the theoretical framework proposed in section 2. A commodities boom allows an expansion of private and government consumption while maintaining balanced budgets (or even reducing public debt). The boost in consumption reduces underemployment in precarious occupations and increases the average income in the informal sector. This improvement in the position of the poorest workers creates wage pressures in the formal sectors. Firms in nontradable activities pass these cost increases on to prices. But when workers in the tradable sector try to keep their relative position and gain higher nominal wages, the increase in nominal incomes in the tradable sector raises the nominal demand for nontradables; relative wages fail to readjust to meet the prevailing social norms. In this context tight monetary policies to counteract incipient inflationary pressures impact the manufacturing sector disproportionately as interest

²⁴Measured by the EMBI+ index produced by the JP Morgan.

rates rise and the exchange rate appreciates. By reducing its capacity utilization and profitability, investment in the tradable sector also tends to fall.

If our interpretation is correct, macroeconomic policy during the boom years contributed to deindustrialization and left the economy in a fragile position when commodity prices fell. The policy prescriptions also failed when the crisis hit - first by increasing government consumption and reducing investment, reinforcing the previous structural change dynamics; later, with attempts to balance the budget, which aggravated the downturn and prolonged the recession. The commodities boom and bust in Brazil exemplify the large external shocks that buffet many developing economies. The standard macroeconomic prescriptions, we argue, can serve to magnify the effects of external shocks with serious adverse implications for economic development. Needless to say, other factors than macroeconomic policy can contribute to poor performance. Other policies – including education, health and industrial policies – are crucial for economic development and, staying with the Brazilian example, the sources of the current, multidimensional crisis also includes corruption scandals, political polarization and class conflict.²⁵

The model can also account for more specific features of the recent Brazilian experience. One is the prominence of the inflation in services, which in the model follows from the increase in the relative price of nontradables as the tradable sector sees a decline in both its profit share and its relative wage. Another is the sectoral developments: both tradable and nontradable sectors initially expand, followed by a squeeze on the tradable sector as the exchange rate appreciates and the profitability of the sector decreases.

In the complete paper (Martins and Skott, 2020), our interpretation is compared to a number of works about the recent Brazilian trajectory, and common aspects to previous contributions are highlighted. Those are suppressed here due to paper size limitations.

4 Conclusion

Mainstream macroeconomic policy prescriptions have been centered around two principles: sound finance with fiscal policies that keep public debt low and a monetary policy focused on inflation targeting. The prescriptions are questionable, though. For advanced economies, structural aggregate demand problems (secular stagnation) may require sustained fiscal stimulus if full employment growth is to be maintained (e.g. Ryoo and Skott 2013, Summers 2015), and inflation targeting may simply validate high unemployment and cause great harm if there is no natural rate of unemployment.²⁶ But the damage from the policy prescriptions can be even greater in developing economies.

Advanced economies have ‘full employment as a guidepost for policy, even if the guidepost is highly imperfect. In dual economies the notion of full employment loses all meaning. Underemployment is pervasive, and the development problem is all about structural transformation and the expansion of the modern sector. In this setting, the twin pillars of sound finance and inflation targeting can impede the development process and lead to premature deindustrialization.

Behind these pillars lies a presumption that when it comes to macroeconomic policy, ‘the rest can be left to the market as long as the government keeps its own house in order (balances its books) and ensures price stability. This presumption is overly optimistic. ‘The rest cannot be left to the market. Macroeconomic policies influence, both directly and via exchange rate, the sectoral composition of output and investment, and these variables are crucial for any development strategy.

There is no reason to expect symmetry between the effects of over and undervaluation of the real exchange rate; Razmi, Rapetti, and Skott (2012) find a negative effect of real exchange rate volatility as well as a positive long-run effect of undervalued exchange rates for developing countries. Balanced

²⁵See, for instance, Singer (2020)

²⁶Cerra et al. (2020) provide a survey of employment hysteresis and the implications for the long-term effects of demand management. Campbell (2020) discuss US evidence on path dependency of the sectoral composition of output as a result of exchange rate movements.

budgets and inflation targeting aggravate the volatility of the real exchange rate and of the demand conditions facing the modern sector in developing economies. The standard policy prescriptions, thus, become impediments to growth and structural transformation in these economies, even if overvaluation of the exchange rate is avoided on average.

By questioning inflation targeting we do not suggest that high inflation is desirable. The sources of price increases are critical, however, for the formulation of a successful development strategy without high inflation, and the New Keynesian Phillips Curve – even with *ad hoc* augmentations – provides an inadequate platform for understanding inflation; this is the case for advanced economies, but even more so for developing ones.

If our argument in this paper is correct, distributional conflict over relative wages are central to inflation in developing economies. Although the modern sector faces an elastic supply of labor, social norms regarding relative wages can create strong inflationary pressures in the formal sector if shocks to domestic demand produce a sharp increase in the average incomes of workers in the informal sector. Inflation is the result of a nexus of demand-determined incomes in the informal sector, relative-wage norms, and cost push inflation in the formal sectors.

Windfall gains from a commodities boom exemplify the dangers from following these policy prescriptions. The gains relax balance of payments constraints and allow the expansion of domestic demand without running public deficits. The joy may be short-lived, however, if the expansion of demand produces inflationary pressures, rising interest rates and an overvalued exchange rate. This scenario – and an ensuing Dutch disease – is perfectly compatible with a macroeconomic policy package of balanced budgets and successful inflation targeting.

Crucially, fairness norms need not present a significant barrier to development. Structural transformation may be facilitated by modest rates of inflation²⁷, but the path dependency of social norms implies that the expansion of the modern sector and the gradual reduction in the wage premium for formal sector workers can be achieved without provoking high or explosive inflation. Full employment is not a meaningful target in developing economies, but a commodities boom provides an opportunity to speed up the development process without squeezing consumption or running into balance of payments problems. Policy can be adjusted so as to guide the windfall gains from a commodities boom towards faster expansion of the modern sector, thereby reducing inflationary pressures and securing both increases in average incomes and reductions in wage inequality as the formal sector expands. Private investment in the tradable sector will hardly accelerate, however, if exchange rate appreciation makes the sector uncompetitive²⁸. Thus, interest rates should be kept low and combined with capital controls in order to avoid exchange rate appreciation and high volatility.

Going beyond the formal analysis in this paper, it is important to stress that significant short-term improvements for low-income groups can be compatible with sustainable development and may indeed promote the development process. Changes in tax structures and public spending patterns influence relative incomes, and the way in which benefits flow to the poor is likely to affect the inflationary implications of the benefits. Improvements in health services, education and security, and investment in infrastructure – including sanitation, public transport, electricity and internet services – can be targeted towards low-income groups and are less likely to set off an inflationary spiral than a general boost to consumption with its derived effects on the market incomes of workers in the nontradable sectors.

Access to public services has been secondary in much of the recent discussion of inequality and

²⁷Anecdotally, but quite strikingly, the average annual inflation rate in Korea was above 10% during 30 years of miracle growth from 1960 to 1990, with several spikes above 25%. Studies consistently have found non-linear effects of inflation on economic growth. Even papers that are explicitly in favor of the thesis that the relation is negative have found that there is no statistical relationship for inflation levels below 8% (Sarel (1996)) or 15% (Barro (1995)), for instance. In another influential paper, Bruno and Easterly (1998) argue that there is no robust evidence in favor of such relationship for inflation levels below 40%, and that the correlation is actually *positive* from 1961-1973.

²⁸For evidence that exchange rate influences investment surges see Libman, Montecino, and Razmi (2019)

welfare policies; the focus instead has been on personal income.²⁹ Public services, however, can be essential for the sustainability of reductions in different types of social inequality.³⁰ And they are highly valued. The 2013 protests that, in some sense, initiated the recent and still ongoing political instability in Brazil were sparked by opposition to an increase in the cost of public transport. According to Antunes and Braga (2014), the underlying anger was rooted in a combination of stagnating social mobility, particularly among those that had recently moved into the formal market, and a demand for better public services. The protests arguably expressed the sentiment that "the quality of life inside the home has improved, but this is not reflected outside" (Haddad (2012))³¹

It should be acknowledged, before closing, that the model in this paper has obvious limitations. An important one is the short-run focus of the analysis. Endogenous changes in labor productivity - whether through learning-by-doing or induced changes in R&D - would also need to be included in the analysis of long-run effects of overvalued exchange rates; as is well known, extensions of this kind can produce development traps (e.g. Ros (2013)). Fiscal policy, moreover, has not been discussed in any detail and industrial policy not at all.

Our purpose in this paper has been quite narrow. Combining and modifying ideas from a range of existing work, we have presented a model of inflationary pressures in developing economies using a model strategy that contours some of the limitations of DSGE-type models in dealing with core elements of those countries: underemployment and structural change. Using this framework, we have shown that a macroeconomic policy package that combines balanced budgets and inflation targeting can produce really bad outcomes also in developing economies.

Appendix A: Short-run comparative statics – constant interest and exchange rate

We have

$$M = F(M, S, Z, \eta, r) = \alpha_M \frac{(1 - \pi_M s)(I(M, S, r) + X(\eta)) + \eta Z \epsilon}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} + I(M, S, r) + X(\eta)$$

$$S = G(M, S, Z, \eta, r) = \alpha_S \frac{p_M}{p_S} \frac{(1 - \pi_M s)(I(M, S, r) + X(\eta)) + \eta Z \epsilon}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)}$$

where

$$F_1 = \frac{\alpha_M}{\alpha_S} \frac{p_S}{p_M} G_1 + I_1 > 0; \quad G_1 = \Omega(1 - \pi_M s) I_1(M, S, r) > 0$$

$$F_2 = \frac{\alpha_M}{\alpha_S} \frac{p_S}{p_M} G_2 + I_2 > 0; \quad G_2 = \Omega(1 - \pi_M s) I_2(M, S, r) > 0$$

$$F_3 = \frac{\alpha_M}{\alpha_S} \frac{p_S}{p_M} G_3 > 0; \quad G_3 = \Omega \eta \epsilon > 0$$

$$F_4 = \frac{\alpha_M}{\alpha_S} \frac{p_S}{p_M} G_4 + X' > 0; \quad G_4 = \Omega[(1 - \pi_M s) X'(\eta) + Z \epsilon] > 0$$

$$F_5 = \frac{\alpha_M}{\alpha_S} \frac{p_S}{p_M} G_5 + I_3 < 0; \quad G_5 = \Omega(1 - \pi_M s) (I_3(M, S, r) < 0$$

$$\Omega = \alpha_S \frac{p_M}{p_S} \frac{1}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)}$$

²⁹See, for instance, Saad Filho (2016) and Lavinias (2013)

³⁰The long-term effects of improvements in health and education may be obvious, but access to public services like transportation also impact professional (as well as leisure) opportunities; Pereira et al. (2020).

³¹It is interesting that about the same time a very similar diagnosis emerged, but related to the role public services and macro policy have on the productive structure of the country: 'Within the factory gates, a continuous improvement in efficiency and productivity. Outside the same gates, unacceptable transaction costs' (Barros and Giambiagi (2008), p. XII).

Using the implicit function theorem, it follows that for any exogenous variable x ,

$$\begin{aligned} \begin{pmatrix} \frac{\partial M}{\partial x} \\ \frac{\partial S}{\partial x} \end{pmatrix} &= \begin{pmatrix} 1 - F_1 & -F_2 \\ -G_1 & 1 - G_2 \end{pmatrix}^{-1} \begin{pmatrix} \frac{\partial F}{\partial x} \\ \frac{\partial G}{\partial x} \end{pmatrix} \\ &= \frac{1}{(1 - F_1)(1 - G_2) - G_1 F_2} \begin{pmatrix} 1 - G_2 & F_2 \\ G_1 & 1 - F_1 \end{pmatrix} \begin{pmatrix} \frac{\partial F}{\partial x} \\ \frac{\partial G}{\partial x} \end{pmatrix} \end{aligned}$$

and – using the results for the signs of partials – we get

$$\begin{aligned} \frac{\partial M}{\partial Z} &= \frac{F_3(1 - G_2) + F_2 G_3}{(1 - F_1)(1 - G_2) - G_1 F_2} > 0; & \frac{\partial S}{\partial Z} &= \frac{G_1 F_3 + (1 - F_1) G_3}{(1 - F_1)(1 - G_2) - G_1 F_2} > 0 \\ \frac{\partial M}{\partial \eta} &= \frac{F_4(1 - G_2) + F_2 G_4}{(1 - F_1)(1 - G_2) - G_1 F_2} > 0; & \frac{\partial S}{\partial \eta} &= \frac{G_1 F_4 + (1 - F_1) G_4}{(1 - F_1)(1 - G_2) - G_1 F_2} > 0 \\ \frac{\partial M}{\partial r} &= \frac{F_5(1 - G_2) + F_2 G_5}{(1 - F_1)(1 - G_2) - G_1 F_2} < 0; & \frac{\partial S}{\partial r} &= \frac{G_1 F_5 + (1 - F_1) G_5}{(1 - F_1)(1 - G_2) - G_1 F_2} < 0 \end{aligned}$$

Turning to net exports, we have equation (10), and with predetermined investment, the link between consumption $C + G$ and the level of output in the tradable sector becomes very simple (see eq. (12)). Hence, using the expressions in Appendix A for the partials F_1, F_2, F_3, G_1 and G_3 , we have $F_1 = F_2 = G_1 = G_2 = 0$ and

$$\begin{aligned} \frac{\partial NX}{\partial Z} &= \left[-\frac{\theta}{\alpha_M} \frac{\partial^{\alpha_M}_{PM}(C + G)}{\partial Z} + \eta \right] p_M \\ &= \left[\frac{-\theta}{\alpha_M} \frac{\partial M}{\partial Z} + \eta \right] p_M \\ &= \left[\frac{-\theta \eta \epsilon}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} + \eta \right] p_M > 0 \end{aligned}$$

where the inequality follows from $0 < \theta < 1$ and, by assumption, $\epsilon \leq 1$ (no fiscal deficit). The term $s(\alpha_M \pi_M + \alpha_S \pi_S)$ in the denominator is the derived effect on domestic saving following a unit increase in consumption. These derived domestic saving effects are positive, and an increase in commodity revenues therefore generates an increase in net exports when investment is predetermined.

Appendix B: Short-run comparative statics – inflation targeting

We have

$$M = \frac{\alpha_M}{p_M}(C + G) + I(M, S, r) + X(\eta) \quad (31)$$

$$S = \frac{\alpha_S}{p_S}(C + G) \quad (32)$$

$$w_A = \frac{\alpha_A}{N - M - S}(C + G) \quad (33)$$

where

$$C + G = \frac{p_M[(1 - \pi_M s)(I + X) + \eta Z \epsilon]}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)}$$

If r and η were to remain constant, an increase in Z will raise M and S (section 2.3 and Appendix B), and $C + G$ must also increase. The average income in the informal sector would go up and with predetermined wages in the formal sectors, inflation would increase. Central banks respond by raising the interest rate r which causes the exchange rate to appreciate, η falls. The policy response

leads to a fall in M , S and $C + G$ (section 2.3, Appendix B and the expression for $C + G$); the rise in w_A is curtailed and the standard interest rate rule (raise interest rates to reduce inflation) is stable.

The new equilibrium, following the rise in Z , must have an increase in S and $C + G$ (they move together) and a fall in M compared to the equilibrium before the commodities boom. To see this, we show that a constant S would lead to a contradiction and that S must increase. Thus, assume that $dZ > 0$, $dr > 0$, $d\eta < 0$, $dS = d(C + G) = 0$. To keep w_A constant, we now must have $dM = 0$ in order to keep $N - M - S$ unchanged. The change in M , however, is given by $dM = \frac{\alpha_M}{p_M}d(C + G) + dI + dX = dI + dX$. Since we know that η has fallen and r has risen, $dX < 0$ and $dI = I_M dM + I_S dS + I_r dr < I_M dM$. It now follows that $(1 - I_M)dM < 0$ and we have reached a contradiction; if r is raised sufficiently to make S unchanged, then the tradable sector must contract and the result would be a decline in informal sector wages. The new equilibrium must involve a smaller rise in r which means that the output of the nontradable formal sector must expand. The decline in M now follows from the observation that an increase in S (and thereby in $C + G$) must be matched by a fall in $M + S$ to prevent an increase in the average income in the informal sector.

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